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## SOME PHASES OF INTRA-ORAL TUMORS<sup>1</sup>

WITH SPECIAL REFERENCE TO TREATMENT BY RADIATION

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THE great variety of tumors occurring at the cephalic end of the body is referable to several factors, including the complex embryological development, the intricate anatomical structure, and the notable exposure to many forms of infection and irritation. No other portion of the body presents such a bewildering field of neoplasms. Tumors of the eye, of the brain, and of the oral cavity each form an extensive department of surgical pathology.

The advent of radiation has occasioned many new experiences, elicited many new considerations, and demanded much more detailed knowledge of the causation and natural history of these tumors than was previously either required or available. It is the purpose of this paper to review some of the older and some of the new phases of one of the groups of tumors, with special reference to the needs of those who undertake to treat these diseases by modern methods.

*Cancer of the lip* occurs in two distinct forms, which vary greatly in clinical course and indications for treatment. The infiltrating form of lip cancer develops on the basis of a long-standing horny induration. It ulcerates and infiltrates, while still remaining an innocent-looking lesion. While

progressing slowly, it is seldom safe to assume integrity of the lymph nodes, if the lesion has existed for some months, and its excision is relatively often followed by local recurrence or metastases. After a wide V-shaped excision the recurrence may be due to the development of a new tumor and not to the survival of old tumor cells. For, in these cases, the whole lip is predisposed to cancer, and sections of the submucosa often show a mucinous degeneration of a wide zone of connective tissue, with round cell infiltration, which are the precursors of cancer. Since the blood and lymph vessels of the lip run transversely, there is a tendency to lateral rather than vertical embolism. On this account there would seem to be an advantage in the treatment by radiation which is not commonly recognized, since this method avoids traumatism and scarring.

Broad flat or warty or papillary tumors of the lip arise generally on a basis of seborrheic dermatitis, and spread rapidly and widely, often in fungating polypoid form, sometimes over the skin of lip and chin. They are impressive and conspicuous lesions but they are distinctly less dangerous than the infiltrating form, if dealt with promptly. Here again the wide area of predisposition places a distinct advantage in radiation over surgery. Lymphatic involvement may be

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delayed, even with large fungating tumors, but once occurring is apt to be rapid and aggressive. The practice of removing the bulk of such tumors by knife or cautery improves the external appearance of the patient promptly, but I doubt if it is a sound theory when radiation is to follow. In this field the much condemned vendor of pastes sometimes secures better results than the orthodox surgeon. Sections through the base of the papillary lesions show a deep layer of protecting lymphocytes, which it seems a pity to sacrifice.

Rare tumors of the lip are encountered with annoying frequency. Mixed tumors of the salivary gland type occur at all ages and may simulate epithelioma. They always lie deep in the tissue and are generally firm, rounded, and at first free from ulceration. Benign angiomas cause swelling of the lip and ulceration and induration which may simulate epithelioma. Chancres and tuberculous ulcers of the lip are usually numbered among the errors of diagnosis made by most experienced surgeons. The only sure way to avoid such errors is to make a very careful biopsy in all lesions that seem atypical. Yet biopsies, in tumors of the lip, seem to be a signal confession of inexperience, and are very seldom justified.

In *cancer of the tongue* two main conditions of origin influence the character and course of the disease. In otherwise normal tongues the irritation of a sharp tooth or ill-fitting plate may give rise to cancer which develops rapidly, ulcerates soon, and early involves the nodes. In treating such a case one may expect a normal response to radiation, which in the tongue is vigorous and effective, owing to the rich supply of blood vessels. Quite a different situation exists in the case of slowly developing cancer in a syphilitic or leukoplakic tongue. Here a wide area of the tongue is predisposed to cancer. The disease may appear at multiple points which eventually fuse, giving a very wide zone which is the seat of super-

ficial cancer. Moreover, the whole organ being the seat of arteriosclerosis, one may expect a less effective response to radiation and deeper scarring. In some series of cases as high as 85 per cent of lingual cancers occurred in syphilitic subjects. It is very difficult to judge of the depth and extent of the disease in such subjects, since much of the organ may be indurated by the syphilitic process. In some cases which I have dissected the cancer was notably superficial and of wide extent, and tended to remain so, but infiltration and metastasis develop in due course as usual.

At the base of the tongue there is a rich supply of mucous glands and the epithelial layer is less horny. In this region many cancers originate beneath the surface, possibly from the ducts of mucous glands, and these may show the structure of transitional cell epithelioma. Lingual papillomas may be an occasional source of carcinomas which are polypoid in form.

In the treatment of lingual cancer surgery must now take a secondary position, and the disease is best treated by interstitial radiation. With this method there are two main and serious disadvantages. First, the insertion of radium may dislodge tumor cells and lead to metastasis, and secondly, adequate radiation produces a diphtheritic inflammation of a wide area of mucosa which is very painful, and undesirable in all respects. I venture to suggest that heavy external radiation, according to Régaud's method, is desirable as the first step in the treatment. Such treatment may destroy vagrant cells, it may devitalize the tumor and prevent the viability of cells dislodged in the insertion of needles, and it may cure certain cases of the transitional type.

A very annoying dryness of the throat may follow extensive radiation for lingual cancer. In such cases sections of the oral mucosa have shown marked degeneration and absence of secretion of the mucous

glands and lymphocytic infiltration of the submucosa.

On the *alveolar ridge* very refractory forms of epithelioma occur, and it is important to determine the exact causes of this resistance to treatment. I find two main types of epithelioma on the alveolar ridge. One is a papillary growth which is slow to invade the periosteum and does not extend deeply along the tooth sockets. The other arises from the epithelial lining of the tooth sockets or the deeper gubernaculum dentis, and tends to invade the periosteum very early. Many of these may be recognized on section of tissue, for they often show features of adamantinoma. In fact, it is sometimes difficult to decide whether one has to deal with an adamantinoma or a squamous carcinoma. For the superficial cases it would seem preferable to attempt removal by diathermia so as to avoid the very painful bone necrosis which regularly follows thorough destruction by radium. In very early cases of this type the anatomy would suggest that surface radiation might be sufficient. In the deeper tumors radiation is accompanied by so much necrosis and pain that it seems to me interdicted, and some other method of treatment should be adopted.

The *tonsil* is the seat of two rather distinct types of epithelioma. One is the ordinary squamous carcinoma, and the other belongs in the group of transitional cell carcinomas. The latter group is the more frequent and many of them at all ages show embryonal features. French authors speak of these as "lympho-epithelioma." The tonsillar lining is composed of delicate stratified cells which show little tendency to hornification, and in the crypts the layer of cells is very thin. There may be some influence from the proximity to lymphoid follicles which endows these cells with peculiar characters and justifies the designation "lympho-epithelium." In any case the transitional

cell tumors are highly susceptible to radiation, and this fact probably accounts for the favorable results of radiation. For the same reasons and others these tumors, spreading widely, are unfavorable for surgery. Similar tumors occur in the vault of the pharynx and in the nares. The high susceptibility of these growths seems to call for an effort to treat them by external and superficial radiation, at least as the preliminary step which may be effective in removing the disease.

*Lymphosarcoma of tonsil and pharynx* is a relatively frequent disease, which still escapes recognition too often by laryngologists. Its specific characters were fully described many years ago by Eisenmenger. It occurs at all ages, often in young healthy subjects and in children. It is unilateral. It is accompanied by considerable congestion and lymphoid overgrowth over much of the pharynx and base of the tongue. It produces rapidly a bulky tumor before ulceration, and swelling of the lymph nodes follows invariably after a short interval. It is in this interval that successful treatment may be instituted while the process is localized. Most of the cases are discovered after tonsillectomy, when much damage has been done by the excision.

In the differential diagnosis I may mention one point of considerable practical value. Lymphoid tumors may occur at almost any point of the nasopharyngeal mucosa. When they are composed of large round cells with many mitoses they are malignant, but when they are composed of small typical lymphocytes, they are usually benign. Both types respond to radiation, the latter often permanently.

*Tumors of the nasal mucosa.* — The Schneiderian membrane gives origin to characteristic forms of carcinoma which are very cellular, the cells being of undifferentiated polyhedral type. They may be classed with the transitional type, but often the

growth is diffuse and the tumor is mistaken for lymphosarcoma. These tumors show rapid growth and the metastases may develop very early before any local tumor is discovered. They are highly sensitive to radiation. This is one of the groups of cases in which the patient may present first a tumor of the neck, without indications of any primary tumor of a mucous membrane. It is also important to know that carcinoma of the nasal mucosa may occur at early ages. In a recent case the patient, a girl of 15 years, presented a tumor of the neck for several months before the original nasal growth was discovered.

Another form of nasal carcinoma shows the structure of adenocarcinoma. It resembles adenoid cystic basal cell carcinoma, and has often been designated as such. It is of much slower growth than true Schneiderian carcinoma, but eventually it may involve the lymph nodes and yield general metastases. Since it contains many mucous globules and mucous cysts, it probably arises from the mucous glands of the nasal mucosa. It is moderately sensitive to radiation.

Since both these common types of nasal tumors are radiosensitive, and since surgery can seldom hope to eradicate the disease completely, it would seem desirable to attempt their treatment first by heavy external radiation.

Epithelial papilloma of the nares is a rare but characteristic clinical condition. It is marked by a slow onset of a nasal papilloma in which the epithelial lining is very abundant, convoluted and papillary, while the cells are not very atypical. The structure is essentially benign. Yet, after extirpation, the usual course is a local recurrence, in somewhat more atypical form, and eventually after several removals the disease may become distinctly malignant. In one case this transformation occurred after a history of several operations, extending over a pe-

riod of ten years. It is a near counterpart of papilloma of the larynx.

Nasopharyngeal myxosarcoma is a very well known, very refractory, and very lethal malignant tumor occurring mainly in children. It arises in the vault of the pharynx, occluding the posterior nares, or in the nasal fossæ, occluding the passages, and distending the bones, and it may protrude into the frontal sinuses. The mucosa of the cheek is another site of election. In all situations, it grows rapidly and causes at first pressure symptoms. Its course is then generally interrupted by attempted removal, after which there is rapid recurrence in more malignant form. The tissue is very susceptible to infection, the onset of which introduces severe sepsis into the picture. Death follows soon, after progressive sepsis and asphyxia. The treatment of this group of cases is a difficult problem. One of the main objects to be accomplished is the prevention of infection and necrosis and for this reason it seems best to avoid destructive radiation in any form. The only successful cases that I know of are two, reported by Crowe and Baylor (*Arch. Surg.*, 1923), who used fractional doses of radium over a period of two or more years, which gradually restrained and eventually controlled the growth. I know of no better illustration of the importance of recognizing the principle of growth restraint in radiation rather than that of killing tumor cells.

Another form of sarcoma of the nasal region is the chondroma of the vomer. This tumor appears in the middle line and causes a slowly progressive swelling at the root of the nose. It soon involves all the bones articulating at this point and has so many attachments as to be inoperable. In the two cases which I have seen, attempted surgical removal followed by radiation for recurrence, ended disastrously.

*Neuro-epithelioma of the superior nares, or fibroglioma of the olfactory bulb.* That



the descriptive pathology of tumors of the nares has not yet been fully written is shown by the recent report by Rocher and Anglade of nine cases of this peculiar neoplasm. The tumors occur in the new born or in very young infants, and rapidly occlude the nares. Later they cause characteristic swelling at the root of the nose or at one side. The structure presents rosettes of neuro-epithelium and cords of nerve fibers. In Clark's cases there were many ganglionic cells. The tumors are highly radiosensitive.

*Carcinomas of the maxillary antrum* are the most frequent forms of malignant tumor obstructing the nares. They are of various types, but the most common form is a squamous carcinoma arising from metaplastic epithelium altered by chronic inflammation and retained secretion. Other types are rare epithelial papillomas, and more common adenocarcinomas arising from mucous glands and characterized by the presence of many mucous globules. The slow progress of many of these growths has led to the assumption that they belong in a class with basal cell carcinoma. I do not share this view, especially since very similar tumors show cylindrical cells and grow rapidly.

The results of surgical and radiation treatment of this group of cases are so unsatisfactory that the main object here to be attained is prevention. Most of the squamous carcinomas give a history of longstanding antrum disease, but the other tumors seem less clearly connected with chronic irritation from retained secretion. Laryngologists who have seen many of these cases urge that the suspicion of carcinoma should be kept in mind in every case of chronic antrum disease, and that the antrum should be drained and explored more frequently.

Instead of reviewing the different forms of antrum tumors, I wish to call attention

to a peculiar disease of this region of which I have seen several cases. It occurs chiefly in children and young adults. It is marked by the signs of a chronic progressive inflammation of all the tissues of the superior maxillary region from mucosa to skin, which produces marked swelling of soft parts and thickening and irregular absorption of the bones. It consists chiefly of a chronic destructive osteitis and cellulitis arising from the antrum. Sections of tissue from such cases fail to show any definite tumor process, but only an overgrowth of blood and lymph vessels, connective tissue, mucoid tissue, and fragments of dissolving or regenerating bone. The disease is generally mistaken for a tumor of the antrum or for a sarcoma of bone. It is not improved by radiation, and is generally refractory to any form of treatment.

True fibrosarcoma of the periosteum of the superior maxilla is a rare but well known condition which is often difficult to separate from the above chronic inflammatory process. It usually grows from the outer surface of the bone but may project inward and involve the antrum and surrounding tissues. It produces a diffuse, firm, slowly progressive swelling, which recurs after operation, resists radiation, becomes infected, and thus forms a very difficult diagnostic and therapeutic problem. For the diagnosis it is necessary to obtain tissue from the deep portions of the growth, otherwise one encounters only inflammatory tissue. I have an impression that the best method of treatment is by fractional doses of radium or X-rays over a long period, without biopsy.

*The control of the lymph nodes* in malignant tumors in and about the mouth and nose must be decided on clinical experience, but some pathological data bear directly on this question.

In all tumors one must recognize the existence of a premetastatic period in which

the nodes are free from invasion. This period varies in individual cases, where it is difficult to estimate, and it varies with the type of the tumor, when it follows definite rules seldom broken. It is very long—years—in tumors of the basal cell type. It is of considerable duration in most squamous carcinomas, but varies with the location of the tumor. In vascular, muscular, mobile organs like the tongue, it may be relatively short, but in the cheek, antrum, and tonsil it has often been noted that metastases appear only after some months. With the transitional cell tumors, it is very short, so that the swollen nodes often precede, by months, the detection of the primary tumor. There is a very distinct difference in the aspect of papillary from that of infiltrating epidermoid carcinoma, the former often reaching considerable bulk before invading the nodes. Adenocarcinomas and true carcinomas of glandular origin produce early metastases, which may be widespread, and such tumors are best classed with mammary cancer in this respect. Ulceration and infection are such efficient aids to metastasis that these complications should generally establish the presumption of existing dissemination. The mode of metastasis of most intra-oral tumors is by lymphatic embolism. This conclusion is based on the failure to find filled lymphatics in the sections of the surrounding tissues, by the recovery of cases after removal of the primary tumor and the nodes separately, and by the distant location of some primary metastases. In some instances, especially in adenocarcinomas and transitional cell carcinomas, the blood vessels may be invaded. Permeation of lymphatic vessels seems to occur in basal cell carcinomas, in recurrent carcinomas of squamous and other types, and I have some evidence that it may occur in transitional cell carcinoma.

These observations regarding the premetastatic period, the special properties of different tumors and the common mode of extension by embolism, leave little support to the extreme surgical procedure of removing the primary tumor and the nodes in bloc dissection in all cases. As a matter of fact, it is now seldom practised. To submit patients to such radical procedures as a blanket rule, in the face of our present knowledge and resources, is unjustifiable. This knowledge calls rather for a careful consideration of all the data in each case and for a plan which meets the needs of each particular case. It may be recalled that Bloodgood found that the excised nodes were free from invasion in 68 per cent of his cases of lip cancer. In a more conservative circle I still find a good many cervical nodes removed because they were swollen, but which were free from carcinoma. Among 257 cases of intra-oral carcinoma Broders found the lymph nodes involved in 103 cases.

The practice of leaving the nodes until they show clinical signs of involvement seems to be justified in view of our present resources from radiation. The cervical nodes have well developed capsules, and the lymphatic tissue has considerable power to restrain the growth of squamous carcinoma, often converting the growth into a long quiescent cystic tumor from which, however, extensions to the next node eventually occur. By heavy external radiation this extension may be delayed for a long time, and occasionally squamous carcinoma in nodes has been completely hornified and calcified. This process may be considerably intensified by interstitial radiation. Especially when the nodes are fixed by invasion of the capsule it seems to me far safer to leave them alone after full radiation. Unless the radiation and extirpation are successful, there is a grave additional hazard in using radium at all, for in the radiated tissues the rem-

nants of squamous carcinoma extending widely along lymphatics and nerve trunks may grow with extreme rapidity. However, extirpation of hardened radiated movable nodes seems to be a relatively safe procedure. In the case of transitional cell carcinoma, Quick and Cutler have shown that external radiation may completely destroy both original tumor and lymph node metastases.

Finally, there is one phase of the pathology of intra-oral and nasal tumors which is of the first importance. This is infection. Infection of the mucous surfaces and cavities by pathogenic and saprophytic microorganisms seems to be one of the chief factors in the chronic irritation which produces the tumors. If it were possible to establish an effective hygiene of the mouth and adjoining cavities, tumors of this region would be greatly reduced in frequency and some of them would no longer appear. The importance of preventive measures along these lines can hardly be overemphasized.

With existing tumors, trauma and infection lead to early ulceration and when the streptococcus is once established in any of these growths the progress is accelerated and the complications multiplied greatly.

In most cases of infected epidermoid carcinoma streptococcal infection proceeds with the extensions of the disease even to the lymph nodes, and often dominates the clinical picture. Microscopic section often shows very active mitotic division of tumor cells about pus foci. The tumor tissue is an extremely favorable soil for the growth of streptococcus. The infection widens the lymph paths and facilitates the extensions of the disease. The hyperemia opens blood vessels. With or without necrosis the patient is depleted by local and general sepsis. Pain is greatly intensified. The effects of radiation are often nullified or turned to the detriment of the case. So paramount are these considerations that it would seem to be a reasonable demand that the control of infection is the first essential in any successful plan of treatment. In fact, with control of infection the progress of the disease is often temporarily checked. To meet this problem will undoubtedly tax the ingenuity of the clinician.

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## RADIUM IN INTRA-ORAL CANCER<sup>1</sup>

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CANCER of the mouth, as encountered in the clinic, is too often but a part of a wide-spread process involving the neck and sometimes the chest. In selecting a treatment obviously the metastases and the general condition of the patient must be taken into account. As a general proposition, partial removal of cancer is bad practice: Occasionally it is necessary in order to relieve some functional impairment and thus to prolong life and add to the sufferer's comfort. The mouth cancers are no exception to those elsewhere from the viewpoint of aim in treatment; this should be, no matter what the method used, complete eradication, provided this can be accomplished without causing the patient's death by the treatment, and provided that the mutilation and destruction of function are within limits that make subsequent life bearable. While, therefore, the treatment of the mouth lesion is often dependent upon other conditions, it nevertheless is such a distinct and separate step in the treatment, and is often the sole treatment, that a presentation of the problems which it presents to the radium therapist is justifiable and profitable.

Treatment complying with the general indications above mentioned, and permanent cure, are obtainable in a high percentage of those mouth cancers which are handled in an early stage of their development, and where the lesion is favorably located, no matter whether the agency employed be radium, surgery, or electrocoagulation. A slogan of those concerned with the study and treatment of cancer is that the ideal time to introduce treatment is at the very onset of the disease. In spite of the triteness of this oft-repeated phrase, it cannot

be stated too often, and is universally neglected, not only by the layman, but often by the doctor, even when it concerns his family and himself. Whatever weapon and whatever method be used in mouth cancers, it is certain that the successes will be in inverse proportion to the duration and extent of the disease. From the favorable-cure percentages of the early cases, there is a steady drop, which in the advanced conditions reaches zero.

*Classification.*—The epitheliomas constitute such an overwhelming majority of the malignant tumors of the mouth that this paper will omit all reference to the other types of carcinoma and the sarcomas. They are, nevertheless, an interesting group from both the standpoints of histopathology and radium therapy.

Basal cell epithelioma, so common on the skin, is very rare in the mouth and never of exactly the same architecture. For practical purposes, all these epitheliomas may be grouped as spinal cell varieties. While the microscopic differentiation from non-epitheliomatous tumors and from other than neoplastic conditions is quite definite, nevertheless there is a great variety of pictures formed by the many types of mixture of adult and embryonic cancer epithelium. The ingenious studies of Broders have done a great deal toward clarifying our conceptions as to the meaning of these differences, and have given a practical method of measuring not only potential malignancy but also of gauging the intensity of radiation necessary to cure. Digressing for a moment at this point to the question of the justifiability of biopsy for purposes of diagnosis, I place myself on the side of those advocating it. While the experienced observer can frequently by the naked eye and the palpating finger not only determine epithelioma but

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very shrewdly estimate its probable malignancy, even in small lesions and where not aided by actual metastases, nevertheless, the final diagnosis depends on microscopical study. During the last two weeks I have seen two epitheliomas of the mouth of definite appearance with negative general findings and in each case, following routine against judgment, I had tissue taken and was shocked to find that the conditions were not cancer. This shock was, of course, mitigated by the realization of the more hopeful prognosis and simpler treatment that was available for the patients. Granting a theoretical danger from taking tissue, it must be extremely small when the frozen section diagnosis is immediately followed by treatment. The advantages obtained by knowledge of the microscopical structure are so great that the dangers of biopsy, if they exist, can be neglected.

Cancer of the mouth is a veritable Proteus, now presenting itself as everted wart-like lesions; now as thickened leukoplakic patches; now as infiltrations scarcely visible, but massive to touch; now as red erysipeloid superficial growths, not palpable at all. All these numerous gross and microscopical classes occur so frequently that they are soon recognizable by those engaged in their treatment.

Depending on their place of origin, the mouth epitheliomas are designated as tongue, floor of the mouth, buccal mucous membrane, gum, tonsil, and palate. When it is no longer possible to determine the original point of development, such terms as "tongue and floor of the mouth cancers" or "tonsil and soft palate cancers" must be employed.

*Variations in malignancy.*—The average of high malignancy is much greater in mouth than in skin or lip epitheliomas. However, every grade and degree is met with, from the local, grossly benign, warty growth remaining small and stationary for months

and even years, to those wild neoplasms which run their entire course of destruction and metastasis in a few months. The microscopical criteria offered by the grading of Broders is very helpful. An analysis of our material is confirmatory of his statement, that grades 3 and 4 are much more likely to spread rapidly and to metastasize than grades 1 and 2.

*General consideration of radiation as applied to epitheliomas.*—Radiation of epithelioma is essentially a surgical problem. Means and methods must be used which permit a highly destructive and intensive dosage to be applied to the growth and at the same time to be kept away from normal surrounding tissues. The early hope that radiation had a highly selective destructive influence on cancer, while sparing normal tissues, has not been realized in the epitheliomas. It is true that one observes this action in some of the adenocarcinomas and in lymphosarcoma and in angiosarcoma.

When radium is used the heavy dosage to the epithelioma and the milder dosage to surrounding normal tissue is securable by direct application on the growth and implantation within it, because of the well-known law of spherical dispersion, by which the intensity varies inversely with the square of the distance. In practical work it is possible in many instances to push aside normal tissues and to increase their distance from the center of radiation, and it is also possible to interpose screens which reduce intensity. With the X-ray, the use of screens and of cross-firing may bring about similar favorable conditions. The inverse square law is of much less importance.

It is not within the limits of this paper even to touch upon the way radiation cures cancer, interesting and instructive as such a discussion could be made. It seems to me extremely doubtful that the effect is dependent on the quantity of ray absorbed, regardless of the wave length. Ten years

ago the guiding principle in ray therapy was that each type of tissue had its lethal dose and the problem was to apply a homogeneous dose of this known quantity. From this viewpoint there has been a reaction to a belief that the radiation in some way builds up the natural resistances of the body and that the cure is effected by the normal defensive agencies of the tissues and humors. While in no way depreciating these effects of radiation, I am convinced that they play but a very small part in the treatment of mouth epitheliomas. Observations on both experimental tumors of rats and on human material have convinced me that there is a very definite lethal dose for these tumors, and that this maximum is fatal to nearly all types and grades. It is true that the embryonic, highly proliferative epitheliomas are killed by a smaller dose. It is also true that there are variations met with in tumors of the same type, and that these differences may range as high as 25 or 30 per cent. The evidence at hand also points to the conclusion that the growth power of tumors can be greatly reduced by dosage 30 per cent under the lethal treatment. When the dosage is below 30 per cent there is little effect on the tumor and in many cases the impression of actual stimulation is given. There is no such thing possible as homogeneous lethal radiation, but it is possible to administer in a given volume radiation in such a way that the minimum point or volume receives the lethal dose and, fortunately, the overdosage of other parts does not result in any serious harm.

So far as my own observations go, I have not been led to believe that the epitheliomas of the oral cavity require a heavier dosage to obtain lethal effects than do those of the skin, the lip, or the uterine cervix. The same general principles are applicable in treating epithelioma wherever it occurs. It is true that the normal tissues of the mouth have to be protected more carefully than

those surrounding the uterine cervix. It is this fact which probably determined that gynecologists were pioneers in radiotherapy, both radium and X-ray.

An actual comparison of the effects of various types of X-radiation and radium gamma radiation from the quantitative standpoints is extremely difficult, owing to the wide differences in quantity. We have made endeavors to compare the erythema effects and to check up the ionization readings, but have never been entirely satisfied with the results. It would seem for the present necessary to employ the erythema dose or electrostatic unit dose in X-ray, and in radium to adhere to filtration and distance in estimating quantities. It is not difficult to establish biological dosage, but, while applicable to both X-ray and radium, it does not greatly clear the question and has the disadvantage of itself being subject to error. The lethal dose of X-ray is not less than eight erythema doses, when epithelioma is considered. Radiation with gamma rays of radium from a small spherical or extremely short tubular apparatus is capable of delivering the lethal dosage at a distance of 1 cm. in one gram 30 minutes; or, as often expressed, in 500 mc. hours. This means that from a central point a sphere 2 cm. in diameter is effectually radiated. When a cube of the same diameter is employed, the extreme tips of the corners receive quite inadequate dosage—only about 50 per cent of the required amount. It is obvious from this that, when a single point is used, the radius must extend to the farthest point of treatment, and that the dose employed should be calculated as for this diameter. For practical purposes in treating lesions in the mouth the absorption of the tissues in reducing dosage can be neglected. It amounts to only a few per cent per centimeter. Single point radiation is only properly applicable to more or less spherical lesions. The advantage of radia-

tion by cube units is very great because it is possible by the juxtaposition of cubes to take in any volume. It is also obvious that in lesions which present the variations that mouth cancers do it is indispensable to vary the unit volume and therefore the unit amounts of radiation as obtained by the product of the amount of radium used by the time. This can be done in milligram hours or by less pretentious figures in gram minutes. Where many points or centers of radiation are employed it is, of course, necessary to calculate the effects of cross-firing. This applies both to implantation where the radiation is in units of volume and in superficial surface radiation where the units are in squares rather than cubes. It is safer in large volumes to use multiple portals. In a very large cube it is convenient to take the eight corners as centers and to apply the central radiation by the cross-firing. Such a method does, of course, radiate well beyond the limits chosen for complete removal, and is not suitable for every case. In practice, it is important to measure accurately the lesion and to determine beforehand just what type of implantation is most desirable.

A question of considerable theoretical importance comes up in connection with the question whether it is (as is usually done) accurate to assume that the product of the amount of radium and the time can be taken to apply to all combinations of these two factors. For practical purposes within the limits of both X-ray and radium dosage as generally used, I believe that the variations are too small to make any essential difference. I find that not a few of the men who know the most about radium with whom I have talked are of the opinion that the biological effects are better or greater with small dosage over a great length of time. It is evident that the dosage may be reduced and the time increased to such an extent that the reparative processes of living tissue

will take care of any damage, and that the formula certainly will not hold. With the X-ray and with radium my own observations go to show that the product is smaller where larger amounts of radiation and shorter units of time are employed. In other words, where very intense dosage is given the time is less than proportionally short as compared to milder intensities and longer times.

*Types of applicators.*—Surface applicators should be made in such a form as to give as near uniform intensity as possible over the entire surface to be treated. This can be accomplished by variations in the arrangement of the radium and must differ considerably according to the form of unit applicator available. Wherever possible we employ a thickness of from 5 mm. to 1 cm. of felt between the applicator and the lesion. In very superficial lesions this thickness of felt can be reduced with advantage. We give to each square centimeter a gram 30 minutes dosage and do not use the method in tumors thicker than 1 centimeter. The radiation is from a small sphere in a 3 mm. brass container. The applicators, where very strong tubes are used—a gram or more—are set in lead and supplied with a long handle. Something of this type actually held in place by a nurse, under watch, is almost necessary in lesions on the back of the tongue, the soft palate, and the tonsil, where surface application is employed. It is often convenient in the more accessible regions of the mouth. Wherever it is convenient to use, we have found the dental compound applicators most useful. They have been serviceable especially in the superficial lesions of the floor of the mouth, of the buccal mucous membrane, and the hard palate. Wherever possible it is advantageous from every standpoint to give the treatment in a single sitting. Where the broken dose method, extending over a week or more, is

employed, a 30 per cent higher total dosage is advisable.

When implantation is chosen we are at present employing exclusively a technic of gold-covered emanation points buried in the tissue, to be withdrawn after the desired dosage has been obtained. We have practically entirely abandoned the bare-glass-tube technic, although some of our very best results were obtained by this method. The filtered tubes do not produce the necrosis and pain which follow the bare-tube technic. It is possible effectually to eliminate epitheliomata of considerable size by this means, almost without pain and without deformity. Whether there is any real advantage or not in the tubes that can be withdrawn, as compared to tubes that are gold-covered and left in place as were the bare emanation tubes, is, of course, a question. Theoretically, it would seem an advantage not to have foreign bodies in this devitalized tissue. When emanation points are left in the tissue, the dosage of 132 mc. hours should be estimated for each millicurie implanted. Another practical advantage of burying, giving the dosage, and removing is that by means of screens of metal, packs of gauze, and dental compound applicators, it is much easier to protect normal tissues during the period of radiation. This is especially true when the individual tubes are strong. We find in practice that we are able to place in a tube (of 0.5 mm. inside diameter and 6 mm. length) a glass containing emanation tube with 32 mc. strength—slightly less than a curie in 30 tubes. I have neglected to state that the decay of the emanation must be taken into account in estimating the dosage. It is convenient to estimate on the average dosage obtained by taking one-half of the value of the emanation at the time of the beginning of treatment and adding to it one-half of the value of the emanation at the end of treatment. These gold tubes can be sterilized either by chemical methods

or by boiling, and can be used over and over again. They offer an extremely convenient form of applicator. The thickness of the gold wall is 0.3 mm.

While the advantage of metal screening has long been known, and particularly advocated by the French, I believe that Dr. Failla, of the General Memorial Hospital, was the first to employ it in applying emanation. He very generously gave us his technic for making gold emanation tubes. We are equally indebted to Dr. Joseph Muir, of the Radium Emanation Corporation of New York, for the technic of covering glass points with gold and fixing in stout strings by which they can be withdrawn. Whether the thicknesses of gold which we are employing at present give the best results, is questionable. It is easily possible to increase the effectiveness of the filter by using lead glass emanation tubes, or by replacing the gold by platinum. The platinum adds about five times to the cost of the filter. It is, of course, possible, too, to improve the filtration by increasing the thickness of the filter. This adds, however, to the size of the applicator, which is, I believe, a disadvantage.

*The field of applicability of radium.*—Unlike the conditions that maintain for surgery, the location of the mouth cancer is not a decisive factor as to the use of radium. Granting the greater ease of treating lesions in the anterior part of the oral cavity, it is nevertheless possible by patience and care to give the same kind of treatment to the posterior part of the tongue, the tonsils, and the pharyngeal wall. This advantage holds for all small and moderate sized lesions. Very extensive cancers of the posterior tongue, if they are deeply infiltrating, and especially if they involve the epiglottis or anterior wall of the larynx, can not be adequately treated without a great risk of destroying these organs and as a result producing a basis for fatal complications. Wide-spread superficial lesions are, as a



rule, best handled by flat applicators and surface treatments. In the deep-lying lesions such surface applications are often of supplementary value to the implantations. Very extensive lesions involving a large part of the tongue and the floor of the mouth, and especially those with definite metastases to the neck, are very doubtful for treatment: the chance of cure is so small and the pain and discomfort from the necessary treatment so great. However, in cancer of the cervix and vagina we have steadily extended the frontier of possible cure and no doubt this will be the history in these mouth cancers. It is our impression that any lesion in the mouth which can be cured by surgical extirpation or by electrocoagulation, can be equally well cured by radium, and that not only from the standpoint of location but also from that of size it has its advantage over the other two methods.

*Past experiences.*—In Baltimore we lay no claim to being pioneers in the treatment of mouth cancer by radium. I have almost exclusively dealt with radium in this paper as it seems to me that X-ray has a much more limited field, if, indeed, any at all, except as a supplementary measure. As early as 1913, inspired by our successes in treating uterine cervical epitheliomas, we turned to those of the mouth. In spite of the fact that we have two tongue cases and one floor-of-the-mouth case still living and well from that time, we abandoned in large measure all endeavor in this field until Janeway and Quick introduced their bare tube technic. Our reasons were that with the cumbersome apparatuses, difficulty in holding them in place, and inadequate protection of normal tissues, it seemed that it was possible to cure only cases that could be equally well treated—and with much less discomfort to the patient—by ordinary surgical procedures. In the advanced cases, while we saw growths favorably affected,

the atrocious discomforts, in combination with the spread of the disease, discouraged treating them with an idea of curing the local mouth lesions. For a number of years we turned aside all operable growths and limited our efforts to palliation, which, it seems to me now, was of questionable value in the more advanced conditions.

The bare tube technic we first used strictly as advocated in his original paper by Dr. Quick. Later, in the thicker growths, and especially in the spherical ones, we employed much larger units of emanation and larger corresponding units of volume. The bare tube technic cures but has the disadvantage of causing undue necrosis and sloughing, and, if this occurs near the periosteum, leads to painful burns which are months in healing. It is my impression that beta ray burns are harder to heal than gamma ray burns and more painful during the process of getting well. As already mentioned, in the larger lesions it was also found very difficult to protect parts of the mouth which we did not desire to treat.

About a year ago we began tentatively, in a few cases, to replace bare glass tubes with gold-screened ones. The clinical effects were so strikingly better from the standpoint of pain and unnecessary burns that almost against preconceived notions we have gone over to them completely, to the annoyance of our technical department, upon whom additional labors have been imposed.

Clean healings with very little slough and pain have been the rule, and whatever the late effects of such treatment after several years may be, at present we are of the opinion that this technic maintains all the advantages and has almost completely done away with the disadvantages of bare tubes and excessive beta radiation. Where the growth is directly attached to periosteum, pain can not be completely avoided. The injection of alcohol into the branches of the V nerve

will doubtless have to be resorted to in some cases. This procedure has been of great value with many of the patients treated by the bare tube technic.

Practically all treatments, both surface applications and implantations, can best be carried out without anesthesia and usually without pain. In extensive lesions the implantations are best done under local anesthesia.

#### CONCLUSIONS

1. Through its wide range of applicability in treating mouth cancer, no location being too remote or difficult, if for no other reason, radium should be given an important place as a means of combating the disease.
2. The total absence of primary mortality is a real advantage.

3. The wide areas and great volume that can be attacked, and the assurance that effective treatment goes well beyond the area of actual destruction, should such take place at all, and that even where the extreme limits of the growth are not reached with an effectual curative dose, there is a chance of retardation, are all in its favor.

4. The methods at present advocated will almost surely be replaced by better ones as greater experience accumulates. The limits of successful radiation are surely steadily extending. If methods are developed for taking care of the neck extensions, either by surgical or radiation or combined methods or by any other means, it is safe to promise that the very extensive mouth lesions will also be met by the radium.

## CERVICAL LYMPH NODES IN INTRA-ORAL CARCINOMA<sup>1</sup>

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THE treatment of the cervical metastases of intra-oral carcinoma has always been a most difficult problem. At the same time it is the keynote of successful therapy, not only in those cases which have already developed metastases, but especially in the earlier stage, when no cervical nodes are palpable. Because of the frequency of adjacent lymphatic involvement following surgical extirpation of the primary intra-oral lesion, removal *en bloc* of these lymphatics became the accepted method of procedure. The only modification has been in the extent of the dissection, that is, whether unilateral or bilateral.

Following the advent of the physical agents, radium and X-ray, into the field of cancer therapy, the policy at Memorial Hospital has been strongly in favor of conservative treatment of the cervical lymphatics in intra-oral carcinoma. The technic of irradiation, with its advancements and refinements, has steadily improved during the past few years. Radium dosage has been increased and deep roentgen ray has given us added facilities for delivering a heavy dosage of radiation to deeper layers.

Because the conservative method of treatment was such a decided departure from the accepted wide *en bloc* dissection method, we have studied the records of the intra-oral group of the years 1917 to 1924, inclusive, that we may, by retrospection, consider the rationale of the method of conservatism in the treatment of the cervical nodes in intra-oral carcinoma.

Only those cases which have been observed for at least two years have been included in this study.

That we may know what proportions of cases are admitted without involvement of nodes, with cervical metastases, operable and inoperable, and also developing nodes after admission, we shall give the statistics. Bearing in mind the variations in this disease in the different locations of the primary lesion, each will be considered separately.

During the 1917-1924 period, 271 cases of lip carcinoma were admitted for treatment at Memorial Hospital. Of the 271 cases, 210, or 77.5 per cent, showed no malignant nodes throughout the period of observation; and 39, or 18.6 per cent, of 210 cases developed nodes that on section proved to be inflammatory. There were 27, or 10 per cent, admitted with operable nodes; 11, or 4 per cent, presented themselves with nodes considered inoperable, and 23, or 8.5 per cent, developed regional metastases after admission. Of those cases entering without nodes, 90.1 per cent did not at any time develop them. As to location of metastases, there were 40 on same side, 3 on opposite side; 9 on both sides, and 9 not stated, *i.e.*, 3 in each group, so that the average is not materially changed. Needless to say, practically all of the 9 cases with nodes on both sides were from the inoperable group.

Carcinoma of the tongue shows a somewhat different statistical picture. Of the 268 cases admitted, 117, or 43.3 per cent, had no malignant nodes throughout, but 33, or 28.2 per cent, of these 117 cases developed inflammatory nodes. This latter condition is consequent chiefly upon oral hygiene.

In the other subdivisions in this group 35, or 13 per cent, were first seen with operable nodes; 39, or 14.5 per cent, had inoperable nodes, and 77, or 28.7 per

<sup>1</sup>Read before the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 30, 1926.

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cent, developed metastases after admission. There were 194 cases admitted free of cervical metastases, and 117, or 60.3 per cent, did not develop them. Eighty-eight cases had metastases on the same side; 8 on the opposite side to lesion, and 41 on both sides.

There were 122 cases of carcinoma on the floor of the mouth admitted to the hospital, and of these, 54, or 44.2 per cent, presented no palpable cervical metastases throughout; 28, or 22.5 per cent, were first seen with operable nodes; 17, or 14.5 per cent, were considered inoperable, and 23, or 18.8 per cent, developed adjacent metastases during the period of observation. As to location of these nodes, it was found that metastases occurred on the same side in 42 instances; opposite side in only 2, and on both sides 24 times.

In the inferior maxilla group, totalling 84 cases, 55, or 65.5 per cent, were free of malignant metastatic nodes throughout, while 9, or 10.7 per cent, were admitted with operable nodes; 10, or 11.9 per cent, an inoperable condition of the neck, and 10, or 11.9 per cent, developed cervical metastases following admission. The region of metastases here was found to be on the same side as the lesion in 21 cases, the opposite side in 2 cases, and on both sides in 5 cases. The inoperable group showed 3 of 5 cases in which were bilateral cervical metastases.

The superior maxilla is fairly comparable to the inferior maxilla in frequency of cervical extension, except in the inoperable subdivision. In a total of 62 cases, 45, or 72.6 per cent, were free of nodes throughout; 6, or 9.7 per cent, were admitted with operable nodes; 2, or 3.2 per cent, had the condition too advanced for surgical removal, and 9, or 14.5 per cent, developed metastases during treatment.

In 17 cases with nodes, out of a total of 62 cases, 12, or 70.6 per cent, were found

on the same side, and 3, or 17.6 per cent, on both sides. Two were not stated.

Carcinoma of the hard palate is not a large series—there were but 31 cases in all. Of these, 24, or 77.4 per cent, had no metastases in neck; 2, or 6.4 per cent, had operable nodes when admitted; 3, or 9.7 per cent, had inoperable nodes, and 2, or 6.4 per cent, developed metastases while under treatment.

The 7 cases with nodes were as follows: 3 on the same side, 2 on the opposite side, and 2 on both sides. The last were found one each in the operable and inoperable groups on admission.

The soft palate is also a rather small group, and though this is generally considered amenable to therapy, a much smaller percentage than we are apt to believe has remained free from cervical nodes throughout. In this group of 34 cases, 20, or 58.8 per cent, had no metastases. There were 4 each, *i.e.*, 11.8 per cent, in operable and inoperable classes on admission. Six, or 17.7 per cent, developed nodes during observation. Another striking fact in this disease location is the frequency of bilateral metastases. It occurred 7 times in the 14 cases with nodes. Only 4 had nodes on the same side. In 3, the location was not stated.

Carcinoma in the tonsillar region is most prone, of all intra-oral groups, to metastasize to regional nodes. In this series of 124 cases, 40, or 32.3 per cent, remained free of cervical nodes throughout. This is probably due to late consultation or tardy diagnosis and treatment, and to the relative frequency of transitional cell type of carcinoma. It is not unusual for a patient to seek medical attention for swelling of one or both sides of the neck. Careful examination shows an apparently insignificant lesion of the tonsil. Microscopically, this section will be diagnosed a transitional cell type of carcinoma. Of the 56 cases admitted without nodes, 40 did not develop



any, *i.e.*, a percentage of 73.2. There were 36, or 25 per cent, admitted with operable cervical metastases, and 32, or 22.1 per cent, in the inoperable class. The average proportion, that is, 16, or 12.5 per cent, developed regional metastases during the period of treatment.

As to site of extension, it was found to be as follows: Same side, 68 cases; opposite side in 6 cases; both sides in 5 cases. In 5, it was not stated.

In 65 cases of carcinoma of antrum, 46, or 70.8 per cent, had no metastases to cervical nodes at any time; 5 patients, or 10.8 per cent, were first seen with operable metastases; 6, or 13.5 per cent, were admitted with inoperable nodes, and 8, or 17.4 per cent, developed metastases while undergoing treatment. There were 13 cases with nodes on the same side as the primary lesion and 4 had them on both sides.

Carcinoma of the larynx has been considered in two divisions—the intrinsic and the extrinsic. There were 105 cases of intrinsic type, of which 73, or 59.5 per cent, had no regional metastases. Only 6, or 5.6 per cent, were admitted with operable nodes, whereas 16, or 15.2 per cent, were first seen with inoperable nodes. Metastases during treatment occurred in 4, or 3.8 per cent.

In comparison, the 99 cases of extrinsic laryngeal carcinoma showed no nodes in 44 cases, a percentage of 44.4. Of the 52 cases admitted with clinical metastases, 11,

or 11.1 per cent, were considered operable, and 41, or 41.4 per cent, were inoperable. Only 3 cases developed metastases during the treatment.

The location of the nodes in laryngeal cancer, intrinsic and extrinsic, was as follows: 48 cases on same side; 1 on opposite side, and 22 on both sides.

In summarizing these groups as they were admitted to the hospital, we find that the percentage of cases that are free of nodes throughout varies from 32.3 per cent in tonsillar lesions to 77.5 per cent in lesions of the lip. These proportions are striking, especially so when it is considered that in earlier days it was more frequent to have patients with advanced disease applying for treatment, than the early localized type.

A true estimate of the relative infrequency of cervical metastases can best be had by considering those cases which are first seen without lymphatic involvement, the so-called surgically favorable. In this series, totalling 983 cases, in which no lymphatic extension could be found clinically at the time of admission to the hospital, a very great proportion remained free of palpable cervical metastases. Intrinsic carcinoma of the larynx is least apt to extend to cervical nodes, 94.8 per cent remaining free throughout. The tongue lesions are at the other extreme, 60.3 per cent showing no cervical node involvement throughout. Figures for

TABLE I

Site of Primary Lesion	Total Cases	No Nodes Through-out	Per Cent of Total	Operable Nodes	Per Cent of Total	Inoperable Nodes	Per Cent of Total	Developing Nodes	Per Cent of Total
Lip .....	271	210	77.5%	27	10 %	11	4 %	23	8.5%
Tongue .....	268	117	43.3%	35	13 %	39	14.5%	77	28.7%
Floor of mouth	122	54	44.2%	28	22.5%	17	14.5%	23	18.8%
Inf. maxilla.....	84	55	65.5%	9	10.7%	10	11.9%	10	11.9%
Sup. maxilla.....	62	45	72.6%	6	9.7%	2	3.2%	9	14.5%
Hard palate.....	31	24	77.4%	2	6.4%	3	9.7%	2	6.4%
Soft palate.....	34	20	58.8%	4	11.8%	4	11.8%	6	17.7%
Buc. mucosa.....	98	59	60.2%	13	13.3%	11	11.2%	15	15.3%
Tonsil .....	124	40	32.3%	36	25 %	32	22.1%	16	12.5%
Antrum .....	65	46	70.8%	5	10.8%	6	13.5%	8	17.4%
Larynx—int. ....	105	73	69.5%	6	5.7%	16	15.2%	4	3.8%
Larynx—ext. ....	99	44	44.4%	11	11.1%	41	41.4%	3	3 %

TABLE II

Primary	Cases Admitted with No Nodes	No Nodes Throughout	Percentage of Cases with No Nodes on Entrance Nodes which did not have Nodes Throughout
Lip .....	233	210	90.1%
Tongue .....	194	117	60.3%
Floor of mouth.....	77	54	70.1%
Inf. maxilla.....	65	55	84.6%
Sup. maxilla.....	54	45	84.3%
Hard palate.....	26	24	92.3%
Soft palate.....	26	20	77 %
Buccal mucosa.....	74	59	79.7%
Tonsil .....	56	40	71.4%
Antrum .....	54	46	85.2%
Larynx—int. ....	77	73	94.8%
Larynx—ext. ....	47	43	91.5%
Total .....	983	786	79.95%

various primary lesion locations are shown in Table II.

Since this is a study of the frequency of metastases to the cervical nodes, we have not included in the statistics the "clinically free of disease" cases, but to explain the percentage difference between the "clinically free" and the number that did not develop cervical metastases, it is necessary to show the causes of death.

*Lip.*—The mortality in this group was 15.7 per cent, that is, 33 deaths in the 210 cases showing no cervical metastases. The primary lesion was uncontrolled in 8 cases; there were 9 recurrences; 9 patients died of intercurrent disease, and in 7 cases the cause of death could not be learned.

*Tongue.*—There were 37 deaths, or 31.6 per cent of 117 cases. Twenty-two patients died of advanced, uncontrollable primary disease; 8 died of local recurrence. In 2 cases, though the tongue showed no disease, the patients died of metastases (1) to stomach, and (1) to esophagus. Four died of intercurrent disease (1 over 6 years). There was 1 operative death, following neck dissection, material from which showed no metastases microscopically. Cause of one death could not be ascertained.

*Floor of mouth.*—There was a mortality of 17, or 31.5 per cent, of cases with no cervical metastases. It is noted that in 6

of the 17 patients that died, the lesion was very advanced. The causes of death in this group were: Uncontrolled primary, 12; recurrence, 1; hemorrhage, 1; intercurrent disease, 1; unknown, 2.

*Superior maxilla.*—In this group with no metastatic cervical nodes throughout, 26 of the 55 patients died, *i.e.*, 47.3 per cent. The causes were as follows: 15 advanced inoperable primary; 5 locally recurrent; 1 operable primary uncontrolled; 1 gastric implantation or a primary neoplasm of stomach. One patient died following external carotid artery ligation; 1 had cardiac failure, and 2 died of unknown causes.

*Inferior maxilla.*—Of the 55 cases free of cervical nodes throughout, there were 35 deaths, *i.e.*, 63.7 per cent. This group presented a large percentage of advanced inoperable primary lesions, there being 20 patients with this condition on admission. Five had local recurrence which could not be controlled, and 8 cases which would be classified as operable, progressed to fatal ending in spite of treatment. One patient died with mediastinal metastases, and one with liver and pancreas involvement. Carcinoma of the inferior maxilla invades bone early. Control of this condition is most difficult. At its earliest stage, because of the proximity to the mandible, adequate irradiation by buried emanation devitalizes

the bone and leads to a prolonged infectious process. This was much more common when bare tubes, rather than gold filtered tubes of emanation, were used for implantation in the growth. Partial resection of the mandible should have been done more frequently in properly selected cases.

*Hard palate.*—There were 3 deaths in this group of 24 cases, *i.e.*, 12.5 per cent, in each case due to local recurrence, though one patient lived nearly seven years, having had four recurrences.

*Soft palate.*—There were 6 deaths of those patients with cancer in this location, though no cervical metastases were noted throughout the period of observation. Two cases were lost track of at 3 and 7 months, and cause of death is unknown; presumably it was due to carcinoma, not intercurrent disease, for cases were inoperably advanced on admission. One each died of the following metastases: esophageal, mediastinal, abdominal, and cerebral.

*Buccal mucosa.*—This group presented a large percentage of very advanced lesions when first seen; of the 18 deaths, *i.e.*, 30.5 per cent of the 59 cases, 12 were of this class. Two died of intercurrent disease (pneumonia and senility); 1 inoperable case lived 5 years with periods of regression, though disease was controlled at no time. There were 3 operable lesions showing no cervical nodes, the cause of death being: (a) uncontrollable primary; (b) liver metastases; (c) obscure abdominal disease (treated outside of hospital).

*Tonsil.*—There were relatively few tonsillar lesions admitted before the appearance of cervical metastases—we have but 56 such cases, of which 40 remained free of local lymphatic involvement. Of these 40, there were 22 deaths—55 per cent. Causes of death and the number were as follows: Local recurrence, 6; hemorrhage, 6; cerebral hemorrhage, 2; carcinoma of esophagus, 1; bronchopneumonia, 1; distant metastases

(groin), 1; lung abscess, 1; senility, 1, and in 3 the cause was not known.

*Antrum.*—This group presents a high mortality, due to advanced, uncontrollable primary disease, for there were 26 cases of totally inoperable carcinoma and 5 cases of recurrent. Two patients died following operation, and 1 of hemorrhage. In 3 cases the cause of death is not stated. Of 46 cases with no palpable cervical nodes, 37 (or 80.4 per cent) died as a result of local disease. The large number of advanced cases is due to the difficulty in diagnosis, chiefly because of surrounding bony walls. Roentgenography is of little assistance in differential diagnosis. Another important factor in the care of carcinoma of the antrum is secondary infection. This requires adequate drainage—adequate not only in extent, but in the proper location.

*Larynx.*—It is not difficult to understand the high mortality rate in laryngeal lesions, interfering as they do with respiration and deglutition.

In the intrinsic group of 73 cases, with a mortality of 53, or 72.6 per cent, there were 25 inoperable cases—21 primary, and 4 recurrent; 28 were operable. The 28 cases classified as operable were so designated by examination of the primary lesion. If it were possible to examine the pre-tracheal chain of lymph nodes, we would undoubtedly place many of the so-called operable group in the inoperable class.

The extrinsic group of laryngeal carcinoma is represented by 43 cases remaining free of cervical nodes, of which 38 (or 88.4 per cent) are dead. These cases must be considered as having been advanced from the beginning, for they were surgically inoperable, and because of the impossibility of accurately determining the extent of the disease either by palpation or visualization, radiotherapy was most difficult. The proximity to cartilage adds another hazard to the therapy.

These figures seem to give ample proof that the conservative treatment of the cervical lymphatics in the therapy of intra-oral carcinoma is a rational one. It is further borne out by the several published statistics by Dr. Quick, in which he has reported on the results of the operable cases, and also on those cases developing operable metastases after admission.

I think that all will agree that the nodes are a protective mechanism, and when involved tend to inhibit the growth of the metastases, and this retardation is assisted by the irradiation, by its action on the tumor itself, and on the tumor bed. The surgery of the metastatic cervical node, with intact capsule, is not more difficult than a dissection of the neck, in which there is no palpable node, but which is taken for granted surgically as being involved.

The relatively large proportion of cases admitted for treatment without metastatic nodes, and which have not developed them, invites speculation as to the reason. In the few reports available on this phase of carcinoma in the oral cavity a higher percentage of lymphatic involvement in the dissected material has been reported.

What is the reason for the relatively small proportion of cervical metastases? In reviewing the method of treatment, it is found that practically every patient admitted for care has been subjected to irradiation of lymphatic drainage areas, whether or not nodes were palpable. The source of these radiations was at first radium—the pack of 6 centimeters, the dosage being 8,000 millicurie-hours. This was applied to each side of the neck. Later this dosage was increased to 10,000 and 12,000 millicurie-hours, and recently, *i.e.*, for the past three or four years, both radium and X-ray have been given, and in practically full dosage. The source of the X-ray is the 200 K.V. outfit. It is true that the erythema in cases so treated is a very decided one, often reaching the stage of superficial destruction

of the epidermis, but this readily heals in from three to four weeks, with no apparent change in the skin, except complete loss of the hair. There is not the brawny, pigmented, telangiectatic condition of the skin which follows the repeated exposure to radiation of longer wave length. After the heavy irradiation, an intense reddening appears in from four to six days, with the usual discomfort of first degree reaction, followed by beginning desquamation in about ten days, which is accompanied by severe itching. As the reaction begins to subside, islets of epidermis are seen on the glistening pink surface and these rapidly enlarge and coalesce to form a soft, pliable, practically normal skin. The last fourth of the total dosage that it is possible to deliver to the tissues is the biologically effective portion; the first fourth, or even half, might well be considered to be a preparatory measure for the final amount of energy that can be applied to the tissue under treatment. In other words, a half of an intense dosage does not produce half the biological effect of an intense dosage.

In support of this contention let me give this résumé of Dr. Ewing's pathological findings after the intense dosage:

"Marked radiation changes have been encountered in lymph nodes which have been exposed to heavy external radiation. The regression has been somewhat different in the well-developed squamous carcinoma and the more radiosensitive tumors in which squamous characters are lacking. A marked thickening of the capsule has been observed in nodes which have been subjected to this treatment. The thickening of the fibrous tissue capsule has been regarded as a barrier to the extension of the disease; many nodes have been encountered in which complete hornification and calcification have replaced the tumor. Such nodes have been observed to remain quiescent over a long period of time.



"An extreme grade of connective tissue reaction has been observed in response to combined high voltage X-rays and radium. In some instances this has been so marked as to stimulate a sarcomatous process. The mode of regression has consisted of fragmentation of the tumor cells and incarceration of islands of tumor cells in actively proliferating connective tissue. This process has been accompanied by a rich exudation of plasma cells and lymphocytes.

"The more radiosensitive type of tumor has shown regression by means of liquefaction necrosis associated with a rich cellular reaction. Complete regression of this type of tumor has been observed to take place in response to a relatively small amount of radiation."

It might be well to make clear at this point that this heavy raying by both radium pack and high voltage X-ray is not given routinely to cases which have operable nodes, and for which a dissection is planned, for such intense dosage naturally delays healing, and may cause local breaking down of scar, which must heal by granulation, and this is slow in such intensely irradiated tissue. Nor are inoperable cervical nodes so treated, because the above dosage cannot be repeated as can a moderate one, which, we feel, offers a better palliative result by protecting the skin for further irradiation externally as well as permitting the implantation of gold tubes, containing emanation, into the tumor mass.

The irradiation of the cervical region, whether or not there were palpable nodes at the time of admission, has had, we be-

lieve, much to do with the relatively small percentage of metastases locally, and has made many operations unnecessary—operations which would otherwise be performed at the time of, or shortly after, the treatment of the primary lesion, when the state of nutrition was below normal. It is not possible to treat, either surgically or radiologically, a primary intra-oral carcinoma without seriously impeding the intake of nourishment. This condition cannot do other than make more hazardous major operative work.

Moreover, the complete neck dissection, with no palpable nodes, is an extreme effort, especially when we know that squamous carcinoma, in the beginning, metastasizes to a single node, or possibly to a small chain of nodes, and can be palpated before capsule perforation.

Considering the figures as herein given, and inferring that heavier irradiation will have more inhibitory effects, we have still more promise for the future.

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## SURGERY IN CASES OF INTRA-ORAL CANCER<sup>1</sup>

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THE results of treatment of intra-oral cancer are dependent on three factors: (1) the stage of the disease at which the patient presents himself for examination; (2) the activity of the growth or the grade of the epithelioma, and (3) the thoroughness of the treatment of the local lesion and the gland-bearing fascia that drains it.

The nation-wide propaganda carried on by the medical profession has apparently done a great deal toward educating the public to the necessity of consulting a physician about the smallest chronic fissure of the lip or minor abrasion of the tongue. Many more patients are presenting themselves with small benign lesions and so-called pre-cancerous lesions than ever before, so that the patient with extensive inoperable cancer of the lip or tongue who has not consulted a physician is quite uncommon. There is no question but that "cancer-week" and other educational measures have yielded results in this regard.

The great problem of to-day, however, is to educate the medical profession to give these patients who have been taught to present themselves early for examination the best possible treatment for the small early lesions. Ten years ago, the patient was referred by the home physician to a surgeon who, if there was any question concerning the nature of the lesion, would excise the lesion by cautery so that a microscopic diagnosis could be made. If the local lesion proved to be malignant, it was excised radically, with the gland-bearing fascia that drained the area. Even if the local lesion did not prove to be malignant the patient

was well rid of it. If all early malignant lesions of the mouth were treated in this manner instead of their being treated without a diagnosis, as so frequently happens, the mortality from cancer of this region would be reduced 25 per cent.

The patient usually gives a history of having been referred by the home physician to a radiologist or a dermatologist, since he does not wish to have an operation unless it is necessary. The local lesion is treated with roentgen rays or radium, and the patient is advised that if the condition recurs surgical measures can then be used. Following such treatment one of two complications arises in patients seen by us: First, the local lesion may be so thoroughly eradicated that the patient believes he is entirely well. Several months or years later an enlarged node appears in the submental, submaxillary, or cervical region and the home physician is again consulted. The patient has an abscessed tooth and this is extracted. Later the lump in the neck is explored only to reveal an inoperable malignant lesion. With the second complication there is not only a return of the local lesion following treatment, but an increase in the malignant condition as metastatic nodes have appeared in the neck. When one sees such a patient one wonders what condition he would be in at the present time if he had had thorough surgical treatment along with roentgen rays or radium instead of treatment by these physical agents alone.

Our results from the treatment of cancer of the mouth by operation and radium coincide with those reported by Simmons.<sup>2</sup>

<sup>1</sup>Read before the Radiological Society of North America, at Milwaukee, Wisconsin, November 30, 1926.

<sup>2</sup>C. C. Simmons: Cancer of the Mouth: The Results of Treatment by Operation and Radiation. Surg., Gynec. and Obst., 1926, XLIII, 377-382.

Generally it may be said that cancer originating in the buccal mucosa is a rapidly growing form of carcinoma and may become inoperable within a few months of the onset of the disease. Simmons reports that in primary cases without clinical evidence of metastasis surgical treatment offers a 35 per cent chance of permanent cure against 15 per cent by irradiation, while in primary cases in which there are clinical signs of metastasis radium offers no chance of permanent cure and radical surgery not more than 5 per cent.

The degree of the malignancy varies with the situation of the lesion. Our experience has been the same as Simmons' in that cancer of the cheek and upper jaw is less malignant than cancer of the tongue or floor of the mouth, probably because the less active type is more likely to occur in this situation.

We have long since given up trying to distinguish the enlarged inflammatory lymph node from one that is malignant, by palpating the cervical regions, and feel more strongly than ever that the immediate lymphatics should be removed with the growth in every case of cancer. In many instances the nodes are not involved, however, and the patients in such cases have the best prospects of cure. At the present time we are inclined to be not quite so radical in the treatment of the earlier cases, relying more on the grade of the malignancy in estimating the prognosis. With high-grade malignancy the most radical operation does not offer as much as less radical treatment in the case of low-grade malignancy.

Simmons' report shows that the lives of patients with primary disease are prolonged by treatment but that patients live longer following operative measures than following irradiation, and, furthermore, that patients with recurrences live longer after irradiation than those not treated. He concludes that the results of treatment depend

more on the differentiation of the cells than on any other factor, which bears out our experience in estimating the prognosis in any type of cancer or following any type of treatment, regardless of the situation.

It has been repeatedly emphasized recently that roentgen-ray and radium treatment cannot stimulate the growth of cancer. One might as well argue that a piece of steel cannot stimulate the growth of cancer. If the cancer is only partially removed with a knife, that part which is left in the body grows more rapidly, probably owing to the increase in the blood supply. Frequently lesions are only partially eradicated by roentgen rays or radium, with the result that there is an increase in the activity of the growth, with metastasis to the neck. Quite often one sees a patient who has had a small growth on the lip for years which is finally treated by roentgen rays or radium and which later develops into an active lesion.

At present there seems to be a marked increase in the number of patients who are presenting themselves with lesions which have become inoperable after roentgen-ray or radium treatment, but which, from the history, could have been removed surgically with a good prognosis at the time treatment was instituted.

There can be no question but that patients with cancer originating in the oral cavity are examined much earlier than those with cancer originating in some other region. The patient's attention is attracted to a lesion in the oral cavity in the beginning of the disease. Undoubtedly it is the insignificance of the lesion in its early stages that often prompts incomplete treatment. When adequate treatment is given cancer of the lip the results are probably better than in cancer of almost any other organ because the lesion is usually discovered early and because the activity of the cancer is of low grade. Simple excision of a low-grade

epithelioma in an early stage will result in cure in some instances, whereas the most radical operation produces few, if any, cures if the growth is of high-grade malignancy or well advanced.

The activity of the growth or the grade of the epithelioma, as brought out by Broders' work, is of great value in determining the treatment of intra-oral cancers. Removal of the submaxillary, submental, or cervical nodes that are involved secondarily to cancer of the mouth in epitheliomas graded 4 offers little permanent benefit, while roentgen-ray or radium treatment is of more value, as seems to have been proved by our experience with cancers of this grade.

It is important to consider the treatment of the local lesion and removal of the gland-bearing fascia that drains it after a diagnosis has been established. The value of surgical diathermy and radium in the treatment of advanced local lesions in the mouth cannot be questioned; results have shown that advanced inoperable lesions have been entirely cleared up, and some seem to have been cured. We feel, however, that all so-called pre-cancerous lesions, thickened leukoplakias, and the early epitheliomas which may be excised with the cautery are best taken care of in this way. Diathermy and radium seeds are reserved for the patients with more advanced cases, when palliation is the best that can be hoped for, although some of these are apparently well.

The plan followed in the Clinic in the treatment of intra-oral cancer is to take care of the primary lesion first, the nodes being removed within the next few days, preferably before any local reaction takes place. If the nodes are excised first, the change in the lymphatic drainage during the period between operations sometimes causes the involvement of a group of nodes that otherwise probably would not have been affected. The difficulty of getting good exposure for

a mouth lesion subsequent to dissection of the neck is well known. In all cases except epitheliomas graded 4, with metastasis, the gland-bearing fascia that drains the lesion is removed. Also, all patients receive roentgen-ray or radium treatment before removal of the nodes, and if the nodes are involved, after their removal. In case metastasis to the nodes has been clinically determined these are excised with cautery along with the group of nodes not involved below. In extensive cases it is often necessary to delay removal of the nodes for a few weeks until the reaction from removal of the local lesion clears up.

In treating cancer of the lip, the local lesion is removed surgically, and a plastic operation is performed if the lesion is a large one. Active lesions and those that have received much previous treatment are removed with cautery knife and if the periosteum of the jaw is affected, surgical diathermy is used to destroy the periosteum as well as the surface of the bone. In treating cancer of the cheek, cautery excision or diathermy is used for the local lesions, the full thickness of the cheek being included if necessary. Radium is used over the neck and the nodes are excised as soon as the local lesion has cleared up enough to warrant it.

In cancer of the tongue or floor of the mouth the local lesion is removed by cautery excision in the early cases. Surgical diathermy is used in advanced cases. In the more advanced cases surgical diathermy and radium seeds are employed, and in the most advanced cases radium seeds only are frequently used. In the case of the smaller lesions the nodes of the neck are removed the following day if possible, before the local reaction occurs. If the mouth lesion is extensive, radium is used over the neck and the nodes are removed as soon as the local condition permits.

In the treatment of cancer of the jaws, surgical diathermy is employed for the lo-



cal lesion. The nodes of the neck are removed when the lesions are active or when the cheek is involved.

#### CONCLUSIONS

1. The education of the medical profession as to the proper method of treatment for pre-cancerous lesions and cancer of the mouth is a serious problem at the present time.

2. Lesions of the mouth of an indeterminate nature should not be treated, but rather removed for microscopic diagnosis.

3. The surgical removal of gland-bearing fascia is the surest method of preventing glandular involvement secondary to cancer of the mouth. In addition, roentgen-rays and radium should be used.

#### DISCUSSION

DR. C. F. BURNAM (Baltimore): Dr. Quick's characterization of my work and general qualifications in treating cancer of the mouth by radiation, could with much more accuracy be applied to himself. In 1913 and 1914, when we tried to apply the same technic to mouth cancer that we had found successful in treating cancer of the cervix, we had to abandon it on account of the severe burns and pain caused by the treatments. The only cases from that period which are still well, we feel on critical analysis, might just as well have been cured by surgery, and with very much less discomfort and pain. As a result of these early experiences, we felt that radiation had not a very definite place in the treatment of mouth cancer, and we were only moved from this false view by the development by Dr. Quick and his colleagues of their bare tube implantation technic.

DR. GEORGE E. PFAHLER (Philadelphia): I have been interested in electrothermic methods and have been using them in the treatment of malignant disease since 1910, but especially since about 1913. I am just as enthusiastic with regard to the use of

these methods as I ever have been, but I would have it distinctly understood that the electrothermic methods are only an adjunct in the treatment and can replace neither surgery nor radiation. Very commonly when the electrothermic methods are used, we must combine both surgery and radiation, as I will illustrate in some of the slides which I brought with me after this hurried call from Dr. Quick.

Electrocoagulation is a convenient method of removing the local growth, and by that process you can easily obtain your specimen from a microscopical study, but you must bear in mind that if you have not removed the disease completely you will have produced a most profound reaction in the surrounding tissues, and the increased congestion in the surrounding parts will bring a new blood supply to any remaining carcinoma cells which are there, and your growth will increase more rapidly than ever before if you stop with that treatment. Therefore, you will find men throughout the country condemning the method because it has been used in that way (the disease incompletely removed). The result is that the disease has grown more rapidly afterwards. If you combine very active radiation in those cases with the removal of all of the disease, if possible, or all microscopic disease, you will succeed in many cases that otherwise would be hopeless. I will illustrate that view of these on the screen and discuss the details as we go along.

Now, first of all, the *epitheliomata of the lip*. I believe, and of course agree with Dr. Judd and all the other speakers, that all carcinomata should be treated as early as possible and as thoroughly as possible; in other words, the treatment must be radical from the beginning, and a little X-ray treatment is just as bad as a little surgical treatment. I am sure that Dr. Judd will agree with me that a little surgical treatment, in other words, cutting into, doing it piecemeal, is

bad surgery and will give bad results in nearly all instances. A little radiation treatment may not make the growth increase more rapidly, but it certainly does not stop the surrounding disease, and only at times, as we have illustrated, heals over the surface, fools the patient, and fools the doctor. That is all a matter of skill. We must bear in mind that there are to-day in the country more trained surgeons than there are radiotherapists, and if we can once bring up our universal technic—I mean the technic of the general radiologist—to the highest point, we will be getting results that will at least equal surgery and I think surpass surgery in general. Certainly the method is, to my mind, superior.

Now then, take this early lesion. It is my practice in a case like this to destroy the local lesion thoroughly by electrocoagulation, after removing a specimen for microscopic study so as to get an accurate histological report. In that way you are taking no risk whatever. But we do not stop there. In each instance we radiate the area of the chin and submaxillary glands as thoroughly as if we felt the malignant disease were there. We know that in many instances it is not there, but clinical experience has taught us that if we use this method we can count on 90 per cent cures. In only one case did we get a subsequent development of metastasis (two years afterwards), and when we traced that case we found that, through some error in the office, the patient did not receive the radiation over the chin and the submaxillary glands, illustrating most forcibly the value of the associated radiation. In that instance we ultimately failed. I will not say more about the lip, because that is a simple procedure.

Now let us consider *epithelioma of the tongue*. I am not using, generally speaking, electrocoagulation primarily on these tongues, but, first of all, treat the entire lymphatic area, including the tongue area,

by highly filtered radium rays. I believe that in the oral cancer we will get better results by the use of radium in sufficient quantity and not by a little quantity. As was illustrated by Dr. Burnam's remarks, in which he referred to half-gram-hour applications, large quantities of radium must be applied and thoroughly filtered, and yet not sufficient to do harm to the healthy tissue. Now in these cases shown by lantern slides, I made no attempt to do this work all myself. I called the surgeon. He ligated the lingual artery. Then, after surface radiation, I destroyed this area by electrocoagulation and inserted radium needles in the sound tissue of the tongue. The patient died three years later in an attack of uremia, not having any local recurrence. I will now speak of another cancer of the tongue. Here is a case concerning which I think all of us will agree that nothing is going to be very effective. No one is going to be very enthusiastic about the use of any method. The late Dr. Ernest Laplace brought this patient to me and said there was nothing he could do. The patient had carcinoma involving the inferior maxilla and the cheek, extending all along the cheek and involving the upper alveolar border, with metastatic lymph nodes in the neck. I asked Professor Laplace to join me in this case, in which we first gave some surface radiation; then we removed half of the lower jaw. I destroyed the entire local disease by electrocoagulation. We then treated the upper jaw with radium and the neck with the X-ray. Here is the back of the jaw [slide shown]; you see the entire bone is involved; here you will see how the growth has pushed the tooth out of its socket. Now there is the patient and this shows the jaw. Here is the wound after the slough separated and I could get him in position for a photograph. Then the first attempt at a plastic operation is shown here, and this is the second. Now that patient was treated in 1915. I have

seen him this Fall; he is still working and has been working almost continuously excepting during the first six months, as a travelling salesman. That, as you see, was about eleven years afterwards. This is the jawbone, afterwards removed, showing the extent of the carcinoma in the jawbone.

I will demonstrate another case showing carcinoma involving the cheek and the lower jawbone as it was in 1923. This is four months later, showing the wound after the slough has been separated. The wound looked healthy and was free from any evidence of the carcinoma. Dr. George Müller helped me in this case. We inserted radium needles throughout the wound in this direction. This shows the earlier stage (1924), at which time Dr. Müller prepared to do the plastic operation to close this mouth. These are the preparatory skin flaps that are to be swung over to close his mouth. This is a picture I made in 1926, showing the mouth closed. This shows where these flaps have been swung over to close this mouth. The jawbone was involved in that instance. That is the sort of thing we can do by a combination of our efforts. In my experience, when you once destroy the disease in the inferior maxilla (it nearly always has invaded close to the inferior dental artery), your electrocoagulation is almost certain to destroy that artery, and then you have, following that, a necrosis and you lose your jaw anyway, so you might as well take it out in the beginning and hasten your result and save that much suffering.

This is another case of carcinoma involving the cheek, destroyed by electrocoagulation. Here again the electrocoagulation has destroyed part of this bone. When you destroy the periosteum, you get necrosis. Then this sequestrum separated and ultimately this area showed no evidence of disease or necrosis and I thought the surgeon was

ready to do a plastic or to let the case alone and count the patient well—and then he turns up with a cough. I make this examination of the chest and find a metastatic tumor in there. It is the first instance I have found in which a local metastasis like that in the chest is secondary to cancer of the mouth. I do not know whether the patient inhaled, during the destruction, a carcinoma cell which kept on growing there, or what was the cause, but it is a new experience for me.

Now here is another case. In 1915 I started to treat him. This plate was made May 27, 1916. The patient came to me in 1915 with carcinoma involving the cheek and inferior maxilla. I destroyed the disease locally and got him well of his cancer, but a necrosis of the lower jawbone followed. Here, you will see, is the condition of the bone when I started, showing the invasion of the carcinoma into the jawbone. This shows an associated infection which in all instances we should eliminate, the associated infection about the mouth. Now there is the beginning; here it shows the action of the jawbone, which finally sloughs out, and this shows the result later. He was still well June 15, 1926, or about eleven years afterwards. This shows the progressive steps. First, we got that sequestrum separated, then more necrosis, and finally I took out this whole part of the jawbone.

This illustrates another type, extensive carcinoma involving the lip, treated by radiation. The patient became practically free from any evidence of the disease and was allowed to go home for a month. Instead of coming back in a month, she came back in six months, with this recurrence. At that stage I felt there was no use in going on with the radiation, so I destroyed the disease by electrocoagulation. That was followed by necrosis of the bone. Then I called on Dr. Ivy, who has gradually re-

built this patient's mouth. Here is a patient treated in 1918, for carcinoma of the pleura and mouth extending over to the inferior maxilla, and we get this necrosis here in the sinus. He has refused, unfortunately, to have his mouth closed since, but he is still well. This is a front view of this same patient. He is running a garage and automobile agency at the present time. Here is a patient, referred to me by Dr. Dachtler, of Toledo, who had treated the case with radiation. You can see the effect, and yet, in spite of all that, during Dr. Dachtler's absence, this recurrence developed and Dr. Dachtler felt that he could do no more. I removed the entire area by electrocoagulation, in 1913. This was closed up later by Prof. Laplace, and the patient is still well.

Now, another case of carcinoma that has been treated by oral methods, with this result. Dr. F. X. Jones assisted in this operation. This is half of the lower jaw removed; you can see evidence of disease in the lower jaw. Suppose I had attempted to destroy that by electrocoagulation? I would have destroyed the inferior dental artery and brought about necrosis; so why not take it out and make a clean wound? I want to show you this failure, and why we failed. This was the result after the destruction by electrocoagulation and ligation of the external carotid. This shows an absence of any local disease. I failed in this case, because of metastasis on the opposite side. I had not given enough radiation on the opposite side of the neck. This shows the bone after removal.

This is carcinoma of the tongue, treated first thoroughly by radiation. We finally got all the disease to disappear except this area, and then removed that recently by electrocoagulation. Now there is an absence of any disease.

I would now like to discuss the general papers. In the first place, with regard to

the slides thrown on the screen by Dr. Judd in which he refers to this and that patient having had radiation: I cannot judge from all of them, but certainly in the case of one man who had had radiation for about a year—the case with metastatic glands on the side of the neck—those of us who were sitting in the front row, and I was not the only one that noticed it, could still see the hair follicles over the area treated. That shows how badly a lot of this radiation is being done, and yet the method is condemned because of those results. I am sorry that I do not know how we can get away from it, but it is because of such radiation that we get these bad effects.

Secondly, I do not feel that we are entirely hopeless or helpless, even in the treatment of those cases that have metastatic lymph nodes, for I have repeatedly seen complete and apparently permanent disappearance of those lymph nodes by thorough radiation, preferably by gamma radiation and gamma radiation packs.

DR. ALBERT SOILAND (Los Angeles): We have just listened to the most advanced information and knowledge on the subject of cancer that has ever been presented before any society in so far as I know. Dr. Pfahler has so thoroughly gone over electrocoagulation, and has touched as well on the other papers, that I will take only a moment. Dr. Ewing's paper dealt with the radiation side of it, and my interpretation was that he favored conservative radiation in all cases of cancer as being better than surgery. On the other hand, Dr. Judd reversed this order and preferred the surgical to the radiological aspect. Dr. Burnam's classical paper covered the scientific attainments in the modern use of radium radiation, and Dr. Duffy gave very nicely Dr. Quick's excellent technic in the work of the Memorial Hospital. Like Dr. Pfahler, I do not believe I clearly understand Dr. Judd's



remarks on the surgical treatment of cancer of the lip. Surely we have all seen patients with recurrent nodes six months or a year or more after a competent surgical removal of the local lesion. The same is equally true with radiation. With our modern knowledge of technic and the action of radiation, however, and with the co-operation of constructive surgery, the future of oral cancers is brighter. In our own clinic on the coast we have, for a great many years, been trying to do what Dr. Judd emphasized; we have been giving radiation treatments to the glandular areas in all cases of the lip, irrespective of how small or how slight the local lesion appeared to be, and I must say that we have had, I believe, as good results as the average radiologist who tries to do conservative work. I am sure the symposium is to be congratulated on this very excellent presentation of oral cancer.

DR. JUDD (closing): I simply want to say, in closing, that I think Dr. Quick and Dr. Burnam deserve a tremendous amount of credit for their persistence and the hard work they are doing on this particular subject. I am very glad Dr. Pfahler spoke about insufficient roentgen ray in these cases. It is undoubtedly true that many of the patients who come to us with poor results following roentgen-ray treatment are those who have had poor treatment. Dr. Soiland spoke of seeing a number of patients on whom radical operations had been carried out and yet there was a local recurrence some time afterwards. Of course we all see such patients, but the question is whether or not the patient had a better opportunity to get well because of the bloc dissection at the same time the growth was removed. We still feel at the Clinic that it is extremely important to

grade the malignancy in these cases. For instance, in cancers that Broders grades 4, we are convinced radical operation is a serious mistake; it simply disseminates the disease, while radium and roentgen-ray therapy offer a great deal. I think the general discussion has led us to believe that the best treatment is a combination of surgery, radium, roentgen ray, and cautery.

DR. BURNAM (closing): I feel that there is very little left for me to say. I hope I have made the point that to cure epithelioma of the mouth by radiation, very accurate and sufficient dosage must be given. There is a range of only 25 or 30 per cent between insufficient treatment and excessive dosage. The inverse square law and the factor of absorption in tissue are so very important that it is difficult to realize, in implantations particularly, how accurate the distribution must be; for instance, if we take a circle and a cube with the same diameters and place the source of radiation at the center of each, the corners of the cube will receive only about one-half the dose that every point of the surface of the sphere is subjected to.

As my part in this symposium was to discuss the treatment of mouth lesions, I omitted reference to treatment of the glands of the neck, and particularly of the metastases. Where the glands are freely movable, and particularly where only one group is involved, I prefer bloc surgical removal to radiation; where the glands are multiple and widely distributed, my preference is flat surface radiation—best with radium packs. Implantation is the method of choice, where the metastatic masses are fixed; usually an open surgical incision is desirable for accuracy. It is surprising how huge masses yield to intensive intratumoral radiation, especially the very malignant grades.

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## INDICATIONS FOR AND TECHNIC OF VENTRICULOGRAPHY<sup>1</sup>

By FRANCIS C. GRANT, M.D., PHILADELPHIA

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THE most important factor in the effective surgical treatment of intracranial lesions is an accurate determination of the position of the lesion. Localization of the pathological process may be based on evidence derived from a painstaking history and careful neurological examination, from inspection of the optic discs and the visual perimetric fields, from the reactions of the vestibular tests or from X-ray findings of bony changes in the skull, calcareous deposits in the tumor or a shift in the position of the pineal gland. But there will still remain a goodly percentage of patients in whom the observed symptoms make the diagnosis of a neoplasm certain, although a close consideration of the collected evidence reveals no clue as to its position within the skull. It is this problem of the individual, who, without question, harbors an unlocalizable tumor which has in great measure been solved by ventriculography.

### INDICATIONS FOR AND TECHNIC OF VENTRICULOGRAPHY

Any intracranial neoplasm which is of sufficient size to produce an increase in intracranial tension will cause variations in the position, size, and shape of the ventricular system. Ventriculography consists in the removal of the cerebrospinal fluid from the ventricles. The fluid is replaced by air. Air is much more permeable to X-ray than is bone. Thus the air shadow offers a

marked contrast to that cast on the roentgenogram by the skull. In this way changes in the normal configuration of the ventricles are made apparent. From these distortions in the ventricular outline a clear conception may be obtained of the position of the tumor which produces them.

Before it is possible intelligently to interpret a ventriculogram a knowledge of the normal anatomy and physiology of the cerebrospinal fluid channels is essential. Within each cerebral hemisphere lies a circumscribed collection of fluid, the lateral ventricle. On its floor lies the fluid-producing mechanism—the choroid plexus. Each lateral ventricle extends in three planes, arching forward into the frontal lobe, backward and laterally into the occipital lobe and curving laterally downward and again forward into the temporal lobe. Thus a lateral ventricle has three horns—anterior, posterior, and inferior. That part of the ventricle from which these horns extend is the vestibule. It is here that the lateral ventricle is largest. Roughly, the vestibule lies 3 cm. posterior to a line drawn perpendicularly over the vertex from one external auditory meatus to the other and at a horizontal level along this line 5 to 7 cm. above the meatus. The exploring cannula should under normal conditions encounter the vestibule at a depth of from  $4\frac{1}{2}$  to 5 cm. from the lateral surface of the brain. The two lateral ventricles should be symmetrical and equal in size and shape.

The only exit for the cerebrospinal fluid formed in each lateral ventricle is through two paired foramina opening from the lower median surface of the anterior horns of the ventricle, about two centimeters be-

<sup>1</sup>From the clinic of Dr. Charles H. Frazier, University Hospital, Philadelphia, and from the Neuro-surgical Clinic of the Post-graduate Hospitals of the University of Pennsylvania.

Read before the Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 29-Dec. 4, 1926.

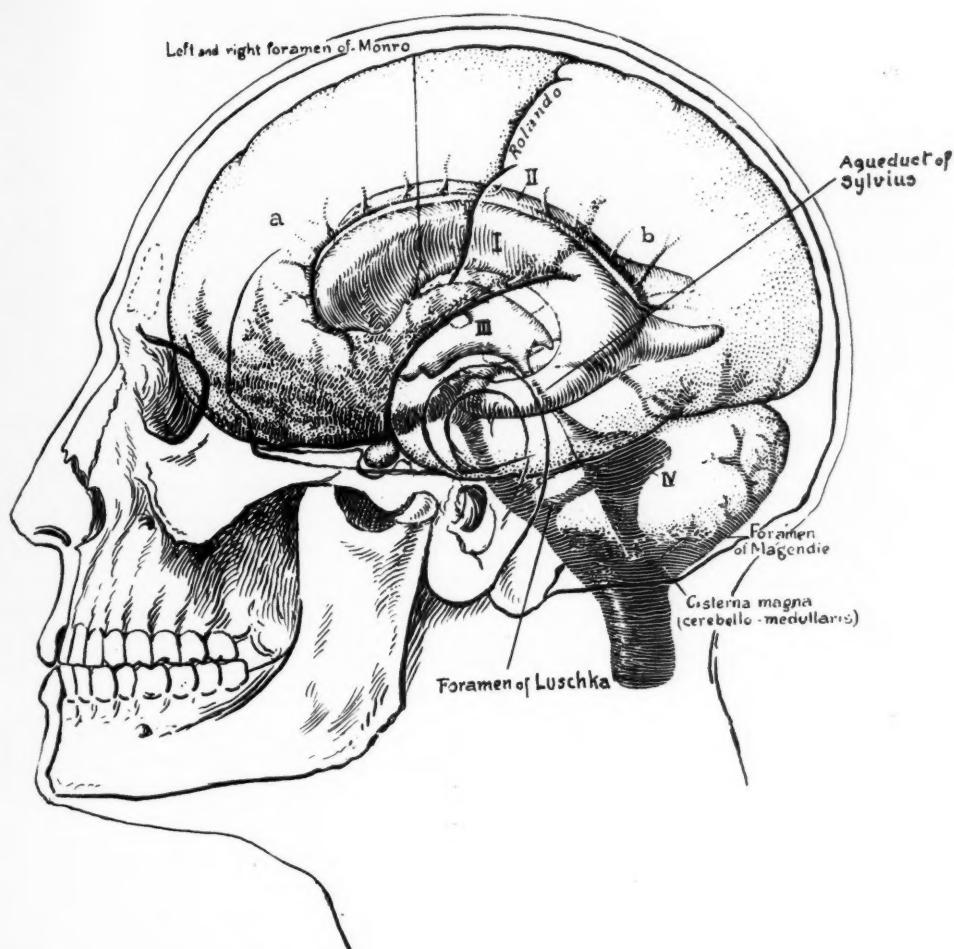


Fig. 1. Diagram (modified from M. Brödel) of ventricular system in its proper relationship to external cranial landmarks. I and II, lateral ventricles; III and IV, third and fourth ventricles; a, anterior horn; b, posterior horn of lateral ventricle.

hind the tips of these horns. These foramina lead into the third ventricle, which lies directly in the mid-line just above and behind the sella turcica and the posterior clinoid processes. From the third ventricle the fluid passes down the mid-line through the aqueduct of Sylvius to the fourth ventricle and basilar cistern, situated below and anterior to the cerebellum, just above the bony rim of the foramen magnum. From the cistern the fluid passes through the for-

men of Luschka into the subarachnoid spaces lying about the cortical vessels. Thence it is carried up over the cortex to be re-absorbed into the blood stream along the vascular channels.

The course of the cerebrospinal fluid is from within the lateral ventricles outward, down the third and fourth ventricles and up over the cortex. This is a most important fact to be borne in mind. In many instances a tumor will obstruct the free circulation of

the fluid. Only from a proper conception of the results of such obstruction on the ventricular system can a localization of the position of these tumors be made.

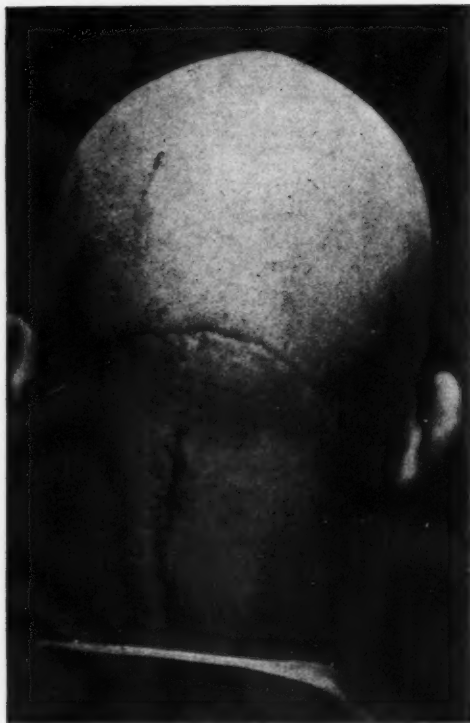


Fig. 2, Case 7. Showing position of incisions in parieto-occipital region of trephine openings through which lateral ventricles are tapped. The lower scar is that of suboccipital craniectomy through which the posterior fossa was approached.

The operative technic involved in the replacement of the fluid in the ventricles by air is a relatively simple procedure. It is immaterial where the trephine opening be made, provided that the needle in reaching the ventricle passes through a silent area of the brain. It has been our custom to place the trephine openings in the parieto-occipital region, 7 cm. above the occipital protuberance and  $1\frac{1}{2}$  cm. lateral to the mid-line. This point of approach has three advan-

tages: First, it passes through a silent cerebral area. Second, we approach the vestibule of the ventricle, which is its widest point and which consequently is least likely to be completely collapsed by the pressure of a tumor. Thirdly, with the patient's head tilted slightly backward the ventricle is entered at a dependent point, efficient drainage of the fluid is possible, and practically all of it may be removed. It is most important to withdraw as much fluid as possible. Unless this is done it may collect in dependent portions of the ventricular system when the plates are taken, prevent air from reaching one part of the ventricle, and simulate the collapse of a horn by a tumor. When possible, both lateral ventricles should be tapped, for only in this way may they both be completely drained. Simultaneous bilateral tap will also determine definitely whether or not there is free communication between the lateral ventricles. If air passes from one needle to the other, the foramen of Monro must be patulous.

The volume of fluid withdrawn should be carefully estimated. Never inject an amount of air exceeding or equal to the quantity of fluid removed. Air is expansile. A smaller volume of air will replace a larger bulk of fluid. In this way the intracranial tension is not increased. The fluid should be aspirated slowly in small amounts and replaced by air, so that sudden changes in intracranial pressure, which might result in the rupture of thin walled vessels, may be avoided. We have had but little success with the replacement of but a part of the fluid with a small amount of air, which theoretically is then made to move from one part of the ventricular system to another by rotation of the head.

The difficult part of ventriculography is proper interpretation of the shadows seen on the X-ray plates. In our opinion the most important single factor in the avoidance of errors in localization by this meth-





Fig. 3, Case 1. Complete obliteration of anterior horn of left ventricle by left frontal lobe tumor.



Fig. 4, Case 2. Anterior horns of both ventricles shifted to left with impingement on left anterior horn by tumor in left frontal lobe.

od is complete removal of the fluid from the ventricles. If this be done then abnormalities in ventricular outline must be due to pathological obstruction and not to the trapping of unexpired fluid in one or other of the ventricular horns. Rotation of the head from one side to the other will in part obviate this. But by far the greater number of our mistakes and failures properly to localize the lesion have been due to incomplete filling of the ventricular system with air.

Routinely, plates are made from four angles, right and left lateral stereoscopic, antero-posterior and postero-anterior. If possible, it is an advantage to place the tube

below the patient's head with the plate above so that the air as it rises will be nearer the plate. It is important in taking the antero-posterior views to have the head exactly in the mid-line and so tilted as to throw the shadow of the third and fourth ventricles above that of the frontal sinuses.

Broadly considered, intracranial tumors cause two main types of changes in the outline of the ventricles—symmetrical and asymmetrical variations in their size, shape, and position.

Asymmetrical variations in configuration are always due to tumors lying within the cerebral hemispheres lateral to the mid-line. The lateral ventricles are most strikingly

affected. An entire horn on one side may be obliterated, both ventricles may be shifted to one side with marked difference in their size, or a filling defect may be seen in one ventricle, or one lateral ventricle may be

of the cerebrospinal fluid. The course of the fluid is impeded by the tumor, it is dammed back, and symmetrical dilatation of the ventricular system above the point of obstruction results. Tumors situated in the

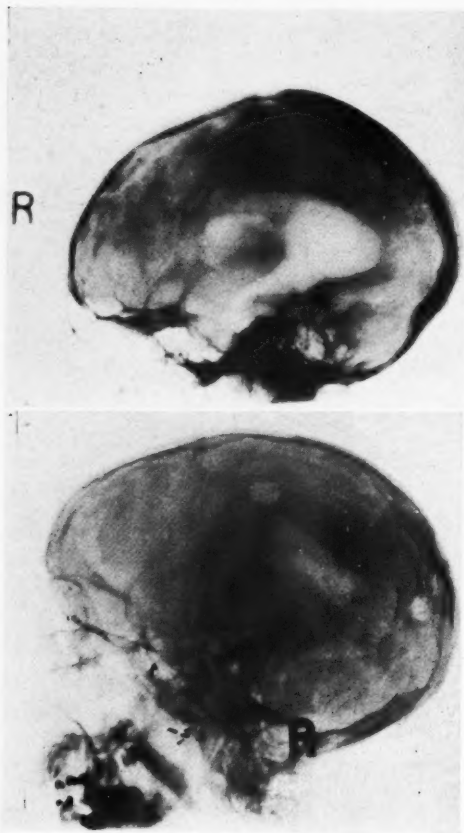


Fig. 5, Case 3 (*above*). Anterior horn of right lateral ventricle obliterated by right frontal lobe tumor.

Fig. 6, Case 4 (*below*). Anterior and inferior horns of right lateral ventricle obliterated by right fronto-temporal tumor.

completely obstructed, with dilatation of its opposite fellow. These effects are due commonly to direct impingement on the lateral ventricles by the tumor mass and not primarily to interference with cerebrospinal fluid circulation.

Symmetrical dilatation of the ventricles is due to obstruction of the free circulation



Fig. 7, Case 5. Left posterior and inferior horns of lateral ventricle obliterated by tumor in left occipito-parietal region.

mid-line between the cerebral hemispheres, impinging on the foramina of Monro or the third ventricles, or in the posterior fossa blocking the fluid in the aqueduct, fourth ventricle, or cistern, produce this symmetrical dilatation. The most difficult differential localization that we are called upon to make from ventriculographic plates is between a supratentorial tumor blocking the third ventricle and a subtentorial lesion. If the third ventricle can be visualized and is dilated, the block lies below the tentorium. If the third ventricle cannot be seen (and since the lateral ventricles are dilated one

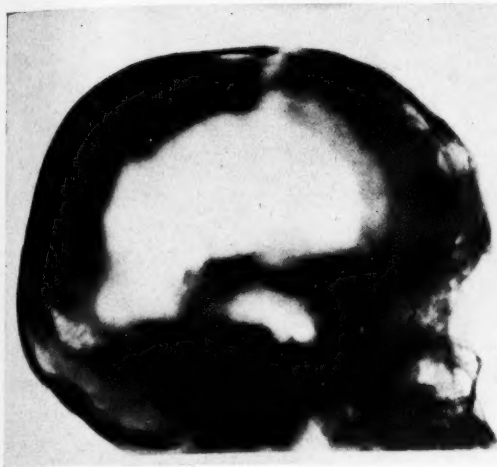


Fig. 8, Case 6. Lateral view of ventricles showing marked internal hydrocephalus with complete absence of third ventricle caused by tumor of pineal gland.

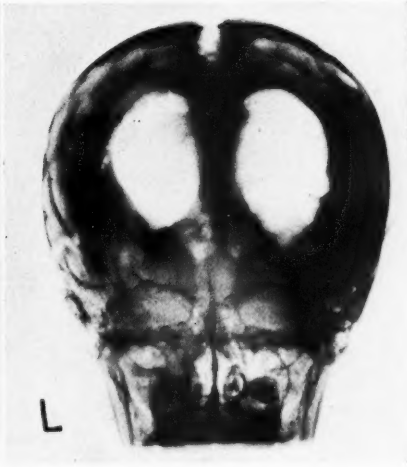


Fig. 9, Case 6. Anterior posterior view of same case showing marked internal hydrocephalus with again complete absence of third ventricle.

would expect the third ventricle to be enlarged and easily visible if the obstruction lay below it), the tumor must of necessity lie in the third ventricle and, therefore, supratentorial. Elsberg and Silbert (1) have brought out two suggestive facts. Subtentorial tumors seem to produce a much more marked dilatation of the anterior horn of the lateral ventricle than of the inferior horn. With supratentorial tumors these two horns are equally expanded. Furthermore, a posterior fossa tumor lying lateral to the mid-line may cause sufficient pressure through the tentorium against the overlying occipital lobe to distort the posterior horn of the lateral ventricle on the same side. The combination, therefore, of a visible third ventricle plus dilated lateral ventricles, with a difference in the size of their posterior horns, would make the subtentorial position of the lesion seem assured. This distinction between a mid-line tumor lying above the tentorium and a neoplasm in the posterior fossa is particularly significant to the neurosurgeon, for the operative ap-

proach to the two regions is so radically different.

The antero-posterior and postero-anterior plates as a rule furnish the most decisive information. Defects in ventricular outline seen from these angles are much more likely to be real and not due to errors in technic. A shift in the position of the lateral ventricles, disproportionate or uniform changes in their size and shape, or obstruction of a horn or of the entire ventricle are easily distinguished. The situation and size of the third and fourth ventricles may be noted. The lateral plates should confirm the findings in the sagittal plane. In interpreting the shadows seen on the lateral plates it should be remembered, as pointed out by Penfield (2), that the size of the posterior horns of the lateral ventricles show much variation, and a complete absence of these horns may not be abnormal. However, a distortion must be seen in all the plates to be of value. Furthermore, the localization should always be weighed in the light of the known clinical findings. If the localiza-

tion based on the ventriculogram places the tumor in an active area of the brain, and if clinically there are no symptoms referable to involvement of that particular area, the evidence from the ventriculogram must be



Fig. 10, Case 7 (see Figure 2). Postero-anterior view showing internal hydrocephalus with marked dilatation of third ventricle due to tumor involving left cerebellar lobe and vermis. Note that in subtentorial tumors the third ventricle is clearly shown, whereas in supratentorial mid-line tumors it is not clearly shown.

very decisive before an exploration is warranted on this ground alone.

The indication for ventriculography is the presence of increased intracranial pressure for which the underlying cause cannot be accurately localized. But every other means at our disposal should be exhausted before air injection is practised. The procedure carries a definite mortality and must not be used indiscriminately. If, following interpretation of the plates, the position of the lesion may be stated with sufficient certainty, it is wise to operate at once and at-

tempt to deal with it. By immediate intervention, many of the severe after-effects of ventriculography may be avoided.

The accompanying table shows the results of ventriculography in a large series of cases gathered from different clinics. These were collected three years ago through the kindness of members of the Neuro-surgical Society. Although the results have unquestionably improved in the meantime, particularly with regard to lowering of the mortality and a decrease in errors due to faulty technic, the figures are still of value. Roughly, in 23 per cent (93 cases) of this series of cases the tumor was localized on the evidence from the ventriculogram alone, the neurological findings being inconclusive. In 44 of these 93 cases, or more than 40 per cent, the neoplasm, when exposed, was amenable to surgical treatment. This refutes definitely the opinion that only the situation of deep-seated inoperable neoplasms can be determined by this method.

#### SUMMARY

Ventriculography in experienced hands is not a hazardous procedure. By its use it is possible accurately to determine the position of otherwise unlocalizable intracranial tumors. But this method should be used only when all others have failed. Technically, in our opinion, the most important single factor in avoiding errors in interpretation of the X-ray plates is the complete removal of the fluid by bilateral ventricular tap, and the injection of air into each lateral ventricle separately. In reaching a conclusion, only obvious defects which are apparent on all the films should be considered. In spite of its dangers, in spite of the possible errors in technic which may render abortive attempts at localization, ventriculography may afford us more positive information about the situation of the lesion than any other procedure. It is our firm conviction



TABLE I  
ANALYSIS OF 392 CASES

I. Cases in which ventriculogram has been of localizing value.....	311	(79.3%)
A. Confirmatory of neurologic diagnosis.....	124	
Percentage of all cases.....	31.6	
Percentage of localized cases.....	40.0	
B. Absence of neurologic signs.....	93	
Percentage of all cases.....	23.7	
Percentage of localized cases.....	30.0	
C. Localization probably correct, but unverified .....	79	
Percentage of all cases.....	20.1	
Percentage of localized cases.....	25.4	
D. Tumor suspects ruled out by ventriculogram .....	15	
Percentage of all cases.....	0.3	
Percentage of localized cases.....	0.4	
II. Tumors localized by ventriculograms alone and susceptible of operative removal .....	44	
Percentage of all cases.....	11.2	
Percentage of localized cases.....	14.1	
III. Operative errors due to ventriculogram (verified at necropsy or subsequent history of case).....	12	
Percentage of all cases.....	0.3	
IV. Errors in technic.....	40	
Percentage of all cases.....	10.1	
V. Mortality following ventriculography.....	32	
Percentage of all cases.....	8.1	

tion that no patient should be given a hopeless prognosis and sent away to die as comfortably as may be because we are unwilling to risk a mortality through the use of air injection. Until we have attempted ventriculography we have no right to tell the

patient that he has an unlocalizable intracranial neoplasm and is beyond our help.

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## RADIOLOGY AS AN AID IN THE DIAGNOSIS OF SKULL AND INTRACRANIAL LESIONS<sup>1</sup>

By MERRILL C. SOSMAN, M.D., BOSTON, MASS.

LESIONS of the skull are, with a few exceptions, quite similar to those of other bones in the body, while those arising in the brain, its coverings and appendages, are not duplicated elsewhere in the human anatomy. As bony tissue, the cranial vault is liable to injuries, anomalies, and deformities; inflammations and repair, and newgrowths, both primary and secondary. *Injuries* (1) will not be considered here except to mention that the secondary or late effects may be of more clinical importance than the immediate results. *Anomalies* of the skull, especially as to size and shape, are rarely of importance, unless one classifies turriccephaly, scaphocephaly, oxycephaly, etc., under this heading. These terms are misleading, being descriptive only, without a suggestion as to etiology or causation. They would be grouped better under the heading "synostosis cranii" (2), which indicates that the trouble is due to early closure of the sutures, with a consequent marked increase in intracranial pressure as the expanding brain pushes against the unyielding skull (Fig. 1). The most bizarre appearances may result, but the key to the situation remains the same—recognition of the fact that one or more of the sutures are, or were, tightly closed during the period ordinarily devoted to growth. For example, the coronal suture may close and thus cause a deep furrow or constriction across the head as the adjacent bones yield slowly to the continually increasing pressure, or all of the sutures may close except

the sagittal, which may be spread apart, giving an unroofed appearance.

An interesting but rare anomaly is that associated with diabetes insipidus, where the X-ray occasionally reveals large defects in the membranous bones of the skull. Only eight such cases have been reported to date (3).

With osteomyelitis, which is fortunately rare in cranial bones, we have the various stages of destruction and bone production similar to those seen elsewhere, but of course in flat bones. Under inflammation and repair one might classify Paget's disease (osteitis deformans) (Fig. 2), which ordinarily produces a typical picture of alternate areas of absorption and production of bone, with an actual increase in the diameter of the involved area, and the typical cottony appearance as described in text books (4). In passing, it is wise to remember that osteogenic sarcoma may and frequently does arise in a bone affected with osteitis deformans (5). Possibly similar in origin but different in expression is the peculiar apparent decalcification of the bones descriptively named by Schüller as "osteoporosis" (6). It may well be that this is simply the absorptive or destructive phase of Paget's disease at work, with the productive phase held in abeyance (Fig. 3). Similarly, if the formative half of the disease alone were present, we might get the appearance known as "leontiasis cranii," where the bone is tremendously thickened, without any evidence of rarefaction. Going even farther afield, it may be that osteomalacia is Paget's disease in a patient without the power of bone regeneration. Even

<sup>1</sup>From the Department of Roentgenology, Peter Bent Brigham Hospital.  
Read before the Radiological Society of North America, at the Twelfth Annual Meeting, at Milwaukee, Nov. 29-Dec. 4, 1926.

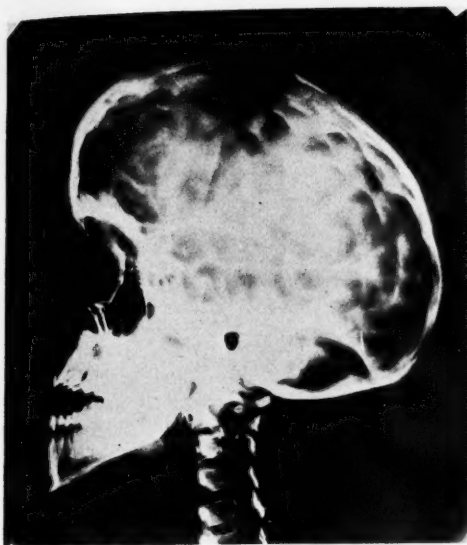


Fig. 1. X-ray No. 37,448. Girl, age 17. *Complaint:* Headaches and dizziness. Blind for 11 years. *P. E. shows* primary optic atrophy. *Operation:* Decompression. *X-ray shows* synostosis cranii with signs of marked intracranial pressure.



Fig. 2. X-ray No. 30,759. Woman, age 66. *Complaint:* Enlargement of head and a swelling in left parietal region. Head has enlarged symmetrically for the past 4 years. A soft swelling in left parietal region, 8 months. *Operation:* Excision of tumor, left parietal bone. *Pathological diagnosis:* Osteogenic sarcoma and Paget's disease. *X-ray shows* typical Paget's disease with an osteogenic sarcoma, largely destructive.

osteitis fibrosa cystica has been seen to acquire, over a period of years, the typical osteitis deformans appearance, so that all of these diverse lesions may really be different expression of or reactions to the same disease—such as an endocrine deficiency or dysfunction.

*Tumors* which are primary in the skull wall are nearly all osteogenic sarcomas, and as such are recognized by the area of bone destruction with irregular bone formation arising from it, with a palpable tumor externally and a history of rapid growth (Fig. 4). (The peculiar reaction of the bone to an invading meningioma may exactly simulate an osteogenic sarcoma. This will be considered later with the brain tumors.) Rarer tumors which have been seen are myeloma, hemangioma cavernosum, cholesteatoma, and osteochondroma. The first was largely destructive, simulating a

metastasis; the angioma (7) was a fine honeycomb or network of beautiful detail, not malignant in appearance or in fact; the cholesteatoma (8) was a sharply outlined, lobulated area of thinning between the two tables of the skull, and the osteochondroma was a pedicled cauliflower mass of bone with the appearance commonly seen in similar benign tumors about the knee joint (Fig. 15).

The secondary or metastatic tumors are largely destructive, such as the hypernephroma with a single or a few large clean-cut areas of destruction in the bone, or the multiple myeloma, with its very diffusely scattered fine punched-out holes. Carcinoma metastasizing from the breast or more particularly from the prostate may cause "reactive" bone formation which often simulates Paget's disease. Close scrutiny will usually reveal the fact that



Fig. 3. X-ray No. 34,678. Man, age 51. *Complaint:* Severe headaches for 2 years, nausea and vomiting. *Operation:* Trephination for removal of specimen. *Pathological report:* Simultaneous proliferation and degeneration of bone, with complete absence of haversian system, similar to Paget's disease. *X-ray shows* localized osteoporosis, cause unknown, possibly atypical Paget's disease.



Fig. 4. X-ray No. 31,317. Negro, male, age 42. *Complaint:* Lump above left eye; duration, since birth; rapid growth, 2 weeks. Pain in left eye and double vision. *P. E. shows* a hard, tender mass in left frontal region, with left exophthalmos. *Operation:* Left frontal bone flap, and removal of tumor of bone. *Pathological diagnosis:* Osteogenic sarcoma. *X-ray shows* irregular bone production and bone destruction compatible with an osteogenic sarcoma.

there is no actual increase in the thickness of the bone, which, if the involvement is extensive, should rule out osteitis deformans. Sarcomas, such as the melanotic type, may metastasize to the vault, and usually cause clean-cut destruction similar to the destruction caused by carcinoma, but metastatic sarcomas are numerically much less frequent. Occasionally it may be impossible to differentiate between metastatic carcinoma (Fig. 5) and *syphilis* (Fig. 6), the latter being notorious for its ability to imitate other lesions. Usually an area of syphilitic osteomyelitis or a gumma is found in the frontal bone, and presents on the X-ray film a ragged, moth-eaten appearance with destruction of bone outweighing production, but with the latter definitely present. The appearance is frequently that of

multiple small irregular lesions which have coalesced, often with similar small areas separate from and more or less surrounding the central larger area, but the diagnosis can be and has been made from a single area no larger than a dime.

Tuberculosis of the cranial bones has not been seen in our clinic. It is said to involve the skull through the accessory sinuses, or from caries of the spine.

In the diagnosis of *brain tumors*, the X-ray may give us general or localizing evidence, or, better, indirect and direct evidence. The general signs are simply those of increased intracranial pressure and are of little value to a surgeon or clinician who is able to recognize ophthalmoscopically a choked disc or a pressure atrophy of the optic nerve. It is wise to remember that





Fig. 5. X-ray No. 44,218. Man, age 35. *Complaint:* Pain and tenderness over right eye and failing vision for 6 months. Vomiting without nausea. *P. E. shows* choked discs. *Operation:* Subtotal removal of tumor in skull wall. *Pathological report:* Metastatic carcinoma. *X-ray shows* irregular, moth-eaten area in the bone, compatible with metastatic carcinoma or syphilis.



Fig. 6. X-ray No. 39,332. Man, age 65. *Complaint:* Pain in left shoulder, and headache. *P. E. shows* irregular skull, non-tender, and a swollen, hard, painful left shoulder. Wassermann positive. *X-ray shows* a moth-eaten area of irregular bone destruction in the parietal and occipital bones compatible with syphilis or metastatic carcinoma. Marked improvement under salvarsan, with partial disappearance of the bony lesions.

children normally have the "convolutional impressions" or "finger-printing" which in an adult mean increased intracranial pressure, and that this appearance may persist up to the twentieth or twenty-fifth year. In children under eight or ten years of age, however, pressure may separate one or more sutures and thus prevent the tell-tale papilledema. Furthermore, the same appearance of increased intracranial pressure is seen with synostosis cranii and hydrocephalus and may be seen in arachnoiditis and meningitis.

A more valuable sign, still indirect, but giving evidence which enables us to locate the *side* of the lesion, is the displacement of the pineal gland (2) (9). As you all know, the calcified pineal gland is visible by means

of the X-ray in 60 per cent of adults over 25 years of age. It normally occupies a position directly in the mid-line of the brain, above and behind the sella, and if we can determine from accurate A.P. and P.A. films that the pineal gland is displaced to right or left of the normal position, then we can safely assume that a tumor or hemorrhage is pushing it away from the side of the lesion. It is possible in an old hemiplegia or similar condition that the shrinkage of the blood clot might *pull* the pineal toward the involved side, but in practice such an event is rarely encountered. Recently Vastine and Kinney (10) have studied the X-rays of several hundred normal skulls in which the pineal gland was visible and have charted the measurements of the

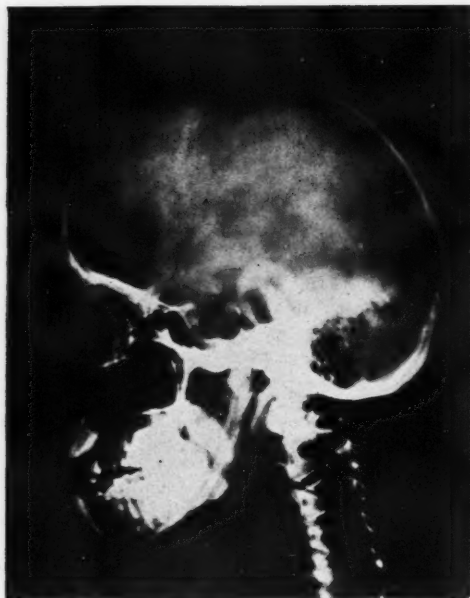


Fig. 7. X-ray No. 19,752. Man, age 30. *Complaint:* Failing vision. *P. E. shows* primary optic atrophy. *Operation:* Right transfrontal with partial removal of a cystic pituitary adenoma. *Pathological report:* Pituitary adenoma. *X-ray shows* an expanded pituitary fossa without signs of increased pressure, compatible with a pituitary adenoma.



Fig. 8. X-ray No. 23,671. Man, age 46. *Complaint:* Weakness, severe headaches, blindness of right eye, and increase in size of hands, feet, and jaw. *P. E. shows* primary optic atrophy and glycosuria. *No operation.* *X-ray shows* marked expansion of pituitary fossa, thickening of cranial bones, large sinuses, and prognathous jaw, compatible with pituitary adenoma and acromegaly.

position of the pineal gland in antero-posterior and vertical dimensions. Arbitrarily establishing a variation of two centimeters as normal, they found that many tumors in the frontal, parietal, temporal, or occipital lobes caused a measurable displacement of the pineal gland beyond the average or normal limits. In short, accurate observations of the position of the pineal shadow in three dimensions may locate a tumor or may add valuable evidence to that already obtained.

Direct evidence of a brain tumor is actual visualization of the tumor by means of calcium deposit in the tumor mass or by the changes in the adjacent bone caused by the tumor. The goal for which we strive is to locate the tumor accurately, and to identify its histological type. If we can do this we

have done our utmost. It is obvious, therefore, that we must first consider the types of brain tumors with which we have to deal. There are four main classes which make up 88 per cent of the 1,146 verified intracranial tumors in Dr. Cushing's clinic—gliomas, pituitary tumors, meningeal tumors, and neuromas. Of these the *gliomas* (those tumors arising from the brain tissue itself) are by far the most common, making up 43 per cent of the whole. Unfortunately only 10 to 12 per cent of these are directly recognizable in the X-ray film by means of calcification within the tumor (11). This is usually mottled or streaky in character, indistinct in outline, and may be located anywhere in the brain tissue (Fig. 9). No doubt many more could be located by study-

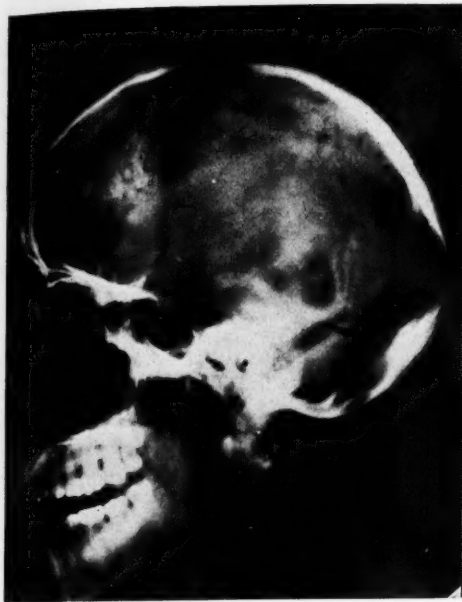


Fig. 9. X-ray No. 31,373. Man, age 47. *Complaint:* Right-sided convulsions, duration 4 years. *P. E. shows* weakness of right side, partial aphasia, and bilateral choked disc. *Operation:* Left trans-frontal. Partial removal of cystic tumor from left temporal lobe. *Pathological report:* Glioma. *X-ray shows* a large irregular mass of calcification in the left temporal region, probably calcification in a glioma.

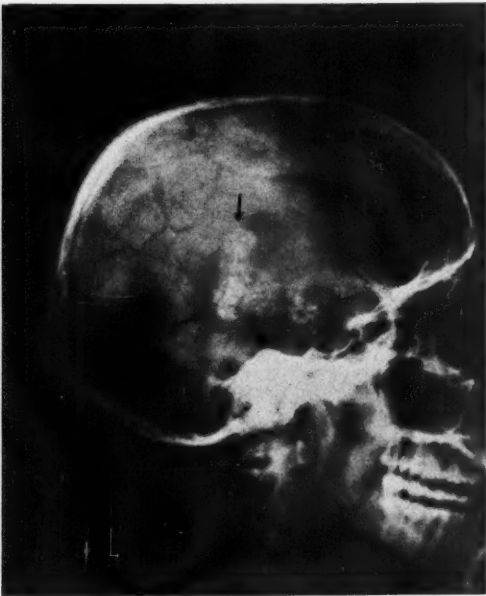


Fig. 10. X-ray No. 27,908. Female, age 27. *Complaint:* Headache, failing vision, nausea and vomiting. *P. E. shows* choked discs and left homonymous hemianopsia. *Operation:* Left temporal, with removal of tumor from the temporal horn of the ventricle. *Pathological report:* Meningioma of choroid plexus. *X-ray shows* a sharply outlined, calcified mass in the position of the temporal horn and posterior portion of the lateral horn of the left ventricle, compatible with a calcified tumor of the choroid plexus.

ing the position of the pineal gland, and Dr. Grant will show you how ventriculography is used for this purpose in certain cases.<sup>2</sup> The *pituitary tumors* are of two types, the common adenoma and the congenital cyst arising from the remnant of Rathke's pouch, known as the cranio-pharyngeal-pouch tumor or suprasellar cyst. The adenomas (12) are recognized on the X-ray films by their effect on the sella, enlarging, deepening, and expanding the pituitary fossa (Fig. 7), sometimes destroying the clinoids and the walls of the fossa. They rarely show the general signs of pressure, and it is wise to remember that any

tumor causing a marked increase in intracranial pressure may cause considerable deformity of the sella (13). In other words, an enlarged sella in a case with evidence of increased intracranial pressure as shown on the X-ray films does not mean a pituitary adenoma. The Rathke's pouch tumors (14), however, frequently cause increased pressure and in 60 per cent of the cases also show enlargement of the pituitary fossa. But it is particularly important that they contain recognizable calcification in a high percentage,—70 per cent of the cases in our series showing the flocculent masses of calcification directly above the sella, at times very faint and at other times in masses the size of hens' eggs (Fig. 12). These

<sup>2</sup>See page 388, this issue.



Fig. 11. X-ray No. 39,224. Man, age 42. *Complaint:* Severe left-sided headaches, duration one year. *P. E. shows* slight weakness of right arm and leg and slight aphasia. *Operation:* Transfrontal, with removal of benign osteoma of ethmoid cells, which had perforated the dura. Plastic closure of perforation and emptying of cranial pneumatocele. *Pathological report:* Osteoma. *X-ray shows* a large, smoothly outlined area of decreased density in the brain, probably air, intracranial pneumatocele.



Fig. 12. X-ray No. 16,629. Boy, age 17. *Complaint:* Failing vision, headaches, vomiting. *P. E. shows* under-development, bilateral primary optic atrophy, bitemporal hemianopsia, paralysis of right third nerve. *Operation:* Transfrontal. Extirpation of suprasellar tumor. *Pathological report:* Craniopharyngeal-pouch tumor. *X-ray shows* enlarged sella, with a flocculent mass of calcification just above it, compatible with a craniopharyngeal-pouch tumor.

are most often found in young persons, frequently children, while the adenomas usually occur in adults. The third group, the *meningeal tumors* (15), can also be located and identified by the X-ray in a high percentage of cases—50 per cent in our series of 141 of these tumors. They reveal themselves by means of their characteristic effects upon the adjacent bone, with irregular erosion of bone and new bone formation, either as flat circumscribed hyperostoses or as distinct areas of thickening with spiculate formation perpendicular to the vault (Fig. 14). Around this area, which is usually fairly well localized and circumscribed, there occurs a radiating network of vascular channels in the bone, characteristic in appearance and not present in sarcomas or syphilis, with which this tumor may be confused (Fig. 13). These “meningiomas”

(formerly called “dural endotheliomas” and before that classed as “sarcomas of the dura”) frequently occur following a trauma, usually in adults, are only locally malignant, and can often be completely removed. The fourth group, the *neurinomas* of the acoustic nerve (16), are rarely recognizable as such in the X-ray films, but frequently give general signs of increased pressure, and their clinical picture is usually clean-cut and distinctive. Occasionally they will cause erosion of the petrous bone which may be identified in the A.P or P.A. views, and they may cause unilateral enlargement of the internal auditory meatus.

The relative frequency of these four types of tumors and the chances of locating and identifying them by means of the X-ray examination is as follows:





Fig. 13. Bone flap removed at operation overlying a meningioma. X-ray shows a circular area of bone absorption with a marked increase in vascularity in the surrounding bone.



Fig. 14. Horizontal section through the bone overlying a meningioma. X-ray shows thickening of the bone with perpendicular spicules typical of meningioma.

Tumor	Cases	Per cent of all brain tumors	Per cent localized by X-ray
Glioma .....	492	43	12
Pituitary Adenoma.....	219	19	90
Rathke's Pouch Tumor ..	55	5	70
Meningioma .....	141	12	50
Acoustic Neurinoma.....	100	9	5
Totals .....	1,007	88%	Avg. 37%

Thus it is evident that we have about one chance in three of identifying a tumor by means of the X-ray examination alone and about a fifty-fifty chance of determining the presence or absence of a brain tumor if we add the indirect signs noted above. Before proceeding to the two-hundred-odd cases which make up the remaining 12 per cent of Dr. Cushing's series, let me emphasize the point that, while the X-ray is of considerable value and is a decided help in certain cases, yet in the majority it is either of no help, or merely confirmatory. In all probability the percentage of cases in which we identify

a tumor previously unsuspected, previously unlocalized, or of a type other than that suspected, would be less than ten—but the positive benefits derived from that 10 per cent make it almost imperative that all cases suspected of having a brain tumor be given the benefit of thorough X-ray examination in competent hands.

Other than the four types of tumors mentioned, there have been found, in order of frequency: (a) metastatic and invasive tumors, rarely visible to us unless there is also involvement of the skull wall; (b) granulomas,—*e.g.*, syphilomas or gummas and tuberculomas,—the latter occasionally becoming calcified; (c) angiomas and peritheliomas, also occasionally containing calcium deposits; (d) congenital tumors, such as teratomas, dermoids, and cholesteatomas, which may show by means of cal-



Fig. 15. A sharply outlined cauliflower mass of bone arising from the floor of the left temporal fossa—benign osteochondroma.

cium in the cyst walls; (e) choroid plexus tumors, occasionally visible (Fig. 10), and (f) a miscellaneous group of rare and unclassified tumors.

Non-tumorous lesions of the brain, as seen in our clinic or as visualized by the X-ray, are in the minority, but it would be well to mention such conditions as hemorrhage, which may displace the pineal gland markedly; arteriosclerosis and intracranial aneurysms, the latter sometimes visible in the X-ray (17) as fine curvilinear shadows rising above the sella and just beside it; abscess of the brain; meningitis; pachymeningitis hemorrhagica, which may simulate a cerebellar tumor and cause an internal hydrocephalus, and pneumatocele, which is usually traumatic, following accidents or operations, but occasionally spontaneous, from erosion of the roof of the frontal or ethmoid sinus by a tumor (18) or infection in the sinus (Fig. 11).

In summary, we may say that the skull wall is subject to the same diseases and in-

juries as any other bone, and that, roughly, a third of the intracranial newgrowths will give direct evidence of their presence on careful radiographic examination.

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## DISCUSSION

DR. M. M. PEET (Ann Arbor, Mich.): For a proper discussion of Dr. Grant's paper, I suppose I should criticize rather than praise, but his work is so complete, so beautiful, that it merits praise rather than criticism. Certainly, with such an excellent demonstration of the localization by ventriculography of otherwise unlocalizable brain tumors, every one will realize that the choice between an unlocalized tumor and a tumor localized by this method lies in favor of the latter. There is no question but that there is a certain amount of danger associated with it. I think the danger is like many of the dangers in surgery, minimized by the experience of the man who is doing the work. Certainly the person who is unfamiliar with the ventricles, with visualization, so to speak, from the outside, would have a greater mortality than the man who had had more experience. I do differ from Dr. Grant on the advisability of injecting both ventricles at the same time, and also on the question of attempting to remove all fluid possible. We formerly attempted to completely empty the ventricles, but some of our patients had such a severe reaction we were very much afraid we were going to increase our mortality. Whether it was the actual result of removing all fluid possible, or due to some other cause, I cannot say, but after some rather strenuous cases we adopted fractional methods, taking out fluid from only one ventricle and not making a serious attempt to get all the fluid even from that one; in other words, we tried to remove the fluid which filled the body, anterior, and descending horns of one side. We place our trephine opening a little differently than does Dr. Grant, making it posterior lateral instead of posterior, going in a little above and behind the ear and tapping the ventricle at its widest point, and then, with the head resting on the occiput, we easily drain the

frontal and descending horns. This, of course, is equally as safe as the posterior approach; in other words, through a silent area. We rotate the head slightly and if more fluid comes freely, we take off a little more, but ordinarily only enough to fill one ventricle, if it quite fills that. The plate as taken may not be quite as graphic or spectacular, and there is always the possibility, of course, in a partial filling, of not showing a defect or having a defect due to incomplete filling, which you might misinterpret. To overcome this, we take several more plates than would otherwise be necessary. I believe that taking several more plates is less dangerous than attempting to take every bit of fluid. We take the routine right and left lateral stereoscopies, the A.P. and P.A., and then we take at least two more stereoscopies, an A.P. lateral position; that is, the head resting on the occiput, but a lateral view, one that will allow the air to come up and completely fill the anterior horn. Then we reverse the patient in the P.A. position and again take the lateral stereoscopic. In this way one will get complete filling of the posterior horn. You can get perfect filling of the whole ventricle without actually filling completely with air. It means that you have to read several plates, that you have to superimpose, in your mind, what you have, instead of having one showing the entire outline at one time. If we suspect a cerebellar lesion, we place the patient's head down: if it is a child, holding it by its feet; if it is an adult, bending the head downward. In this way the air enters the aqueduct and frequently the fourth ventricle. I have seen the fourth ventricle by this position when it could not be visualized in a lateral position. I think it is a technic that is of great value. The only real difference between the technic Dr. Grant has been using and ours is a question of partial filling, and our object in partial filling is to have slightly less mortality.

DR. P. M. HICKEY (Ann Arbor, Mich.): I simply rise to express the opinion that ventriculography is a highly specialized procedure which is not to be lightly considered, and however simple it looks in selected cases on the screen, the interpretation of ventriculograms is a highly technical procedure which requires long experience and precise knowledge of the anatomy of the brain. Therefore I would like to say to the radiologists present that this is a procedure which should be undertaken only in association with a very competent neurologic surgeon. It is a method of diagnosis which should not be carried out except by one who has had the necessary technical training to do it properly.

DR. L. T. LEWALD (New York): I would like to record here the fact that the *pineal gland can be shown in normal subjects as early as ten or twelve years*, and not, as is the usual impression, beginning at the age of thirty years. Now it so happens that I have been fortunate enough to examine a good many young subjects and I have a number of cases in which the pineal gland can be made visible on a good lateral stereoscopic radiograph, or single radiograph, as early as ten or twelve years. I think that probably the lime salt deposits in the pineal gland are present at even a much earlier age than this, and I would like to drop the term "calcification of the pineal gland" in describing the radiograph and simply designate it as the "pineal shadow."

DR. GRANT (closing): There is very little left for me to say. Dr. Peet has suggested to you another method of doing a ventriculogram by means of the fractional injections of air and rotation of the head in various directions so that the ventricular system is outlined piecemeal and not as a whole. That is unquestionably a possibility. However, while it is said to carry a lowered mortality, no one has ever brought

forward any figures to prove this point. Nevertheless, we are in the position of the burnt child that fears the fire. We played with fractional introduction of air and were unsuccessful. That, it is quite conceivable, was our fault and not the fault of the method. Be that as it may, we abandoned it and came back to the bilateral tap with as complete removal of the fluid as possible.

Dr. Hickey and Dr. Pierson brought up two extremely important points. In the first place, ventriculography should not be undertaken unless you are experienced in its use and unless you have within easy reach a neurological surgeon who is capable of handling intracranial conditions and intracranial crises. It is not the type of procedure that can be done offhand in isolated clinics, which will require the transportation of the patient over a long distance to a neurological surgeon. General surgeons, unfortunately, in the great majority of cases, are unequal to meet the crisis that may follow ventriculography.

With regard to ventricular estimations, it is unquestionably a very important step in advance. Unfortunately, it did not lie within the scope of my paper and I did not mention it. I hope to take it up a little more thoroughly in the hour that has been allotted to me to discuss a larger series of ventricular cases. It is also important that, as soon as the diagnosis is made following ventriculography, the patient should be operated on, and I do not mean that any delay should follow. If you do your ventriculogram at nine o'clock in the morning and have the diagnosis by ten, which is perfectly possible, the patient should have an osteoplastic flap performed by eleven o'clock on the same day, and an attempt should be made to remove the tumor.

DR. SOSMAN (closing): There are just two points, one in relation to the pineal. We also have seen a fair frequency of cases with calcium deposit in the pineal gland—



patients as young as ten or twelve years—but they are relatively infrequent and do not mean anything as far as we can tell. I simply gave the percentage above thirty in order that we might estimate the value of this method of measuring the pineal in the localization of brain tumors.

The second point was, I would like to

agree with Dr. Pierson in choosing the middle ground between the fractional method of ventriculography suggested, and the complete filling with air that Dr. Grant recommends. We have tried both methods and in the few cases we now do, the few cases we find it necessary to do, we usually try to fill one ventricle completely, but not both.

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**Effect of roentgen rays on carcinoma.—**

The history of a woman 74 years of age is related, who suffered from a basal cell carcinoma of the left thigh. The growth resembled a cauliflower, was ulcerated, had a very bad odor, and was extremely painful. Roentgen therapy was given on three successive days, 8 H on each day, through 0.3 millimeter zinc, corresponding to about 2 S.U.D. The field was large enough to cover one centimeter of healthy tissue around the tumor. Shortly after the treatment, the pain lessened. Four weeks later, 12 H, through 4.0 aluminum, were administered to the tumor only. No epithelization took place. After six months, the site of the original tumor was still necrotic. A biopsy was negative for carcinoma. Twenty-four H, through 2.0 aluminum, were given again. Another biopsy

three months after this treatment did not reveal any signs of malignancy. As there was no tendency towards healing fifteen months after the beginning of the treatments, transplantation was done, which took well.

From these observations, the author concludes that, following irradiation, two processes distinctly different from each other take place; one is the destruction of the tumor, the other is the formation of scar tissue. It seems that one can appear without the other. For malignancies in internal organs, the dose should consequently never be high enough to injure normal tissue.

E. A. POHLE, M.D.

*Contribution to the Mechanism of Effect of Roentgen Rays on Carcinoma. J. Borak. Strahlentherapie, 1927, XXV, 105.*

## ROENTGEN DIAGNOSIS OF NASAL SINUS DISEASE<sup>1</sup>

By H. J. ULLMANN, M.D.,

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AS soon as the importance of focal infection as the etiological factor in a large proportion of ailments was demonstrated, the exodontists and rhinolaryngologists came into their own. If one suffered from arthritis, neuritis, or retinitis, teeth and tonsils must be ectomized. And many were the cures resulting.

There were, however, many who, without teeth or tonsils, still presented signs and symptoms of focal infection. Of these, a number were found suffering from obvious sinus disease and were relieved by suitable treatment, but there was still a residuum who showed no evidence of sinus infection, or at least that was the report returned by the rhinologist. It is surprising that, although the dentist has long recognized the fact that it is dangerous to say that a tooth is normal in the face of roentgenological evidence to the contrary, the rhinologist has no hesitancy in looking into a nose, transilluminating, and then reporting absence of sinus disease when the roentgenologist reports not only pathology, but the type and exact location. It was only about two years ago that a rhinologist in Santa Barbara stated before a dental society meeting that pus could not be demonstrated by the roentgen ray. As the roentgenologist had already located the oral infection the internist called upon him for further help.

The situation in those centers where the internist, the rhinologist, and the roentgenologist are in close co-operation is rapidly changing. In Santa Barbara a number of the internists now refer patients for sinus examination as routine when searching for foci of infection. The results have been surprising to all of us. Some form of sinus

pathology is as common as dental pathology in those individuals who have regular and thorough care of their teeth. It was also found that sphenoidal pathology occurred as frequently as pathology in the other sinuses and it was not rare to find it present when the others were clear. When we began the examination of the sphenoids by the Granger method, we soon became worried for fear we were reporting positive findings too frequently, but confirmation of our reports by the rhinologists and internists soon convinced us that we were not finding too many, but that too many had formerly been overlooked. Dr. P. C. Means, a rhinologist who has examined and treated a large number of the patients examined by us, was asked to express his opinion of positive roentgen findings in the absence of clinical evidence. The following is his reply:

"In this community, at least, I believe many of our ideas concerning sinus disease have materially changed during the last three years. As in many other disease conditions we have accepted the roentgen interpretations when they were confirmed very positively by the physical signs and symptoms. Properly taken films carefully interpreted by the competent roentgenologist I, at least, am inclined to accept in the face of absence of positive nasal signs of sinusitis.

"During the past year especially, I have treated a considerable number of roentgen-diagnosed cases where I could see no justification on examination for such treatment, and relieved conditions which I should not formerly have thought due to a nasal infection. Especially is this true of the sphenoid when taken in the Granger position.

"In common with many others, I suppose, I could see little probability that trustworthy findings could be so made, but I have many

<sup>1</sup>Read before the Radiological Society of North America, at Milwaukee, Nov. 29-Dec. 4, 1926.

times confirmed the roentgen diagnosis, and treatment has added proof.

"It is not uncommon for me to see patients who have been told by specialists in other cities that they have no sinus disease. Dr. Ullmann would insist that his films showed sinusitis, and careful, persistent treatment has led to relief of conditions known to be caused or aggravated by a focus of infection."

I have been surprised, when visiting other roentgenologists, to find that there is an impression that the examination of the sphenoidal region by the Granger method and the interpretation of the findings is a difficult matter. We now consider sphenoidal conditions no more difficult of interpretation than those of the other nasal sinuses. The method used is that described by Granger, without any modification.

Dr. Granger has described the method so thoroughly that repetition is unnecessary but certain points should be emphasized. It is absolutely essential that the head should slope downward as originally described. Sinus boards designed for use with the patient upright defeat their purpose, as it is necessary for any fluid contents of the sphenoid to gravitate toward the roof in order to produce the characteristic changes in the Granger or G line. It is necessary to make sure that the patient is resting both the alveolar process and the glabella on the mask, or the region may be missing on the film. The sinus board must be  $17^\circ$  and the central ray be directed just caudad to the external auditory meatus and perpendicular to the table.

With a properly taken film the region of the G-line is clearly visible behind the frontals. It is spoken of as the region of, rather than, the G-line, because under pathological conditions the G-line may be absent. The interpretation of sphenoidal conditions, according to Granger, depends entirely on

the appearance of the G-line and the sphenoidal density immediately beneath. The changes in the line and density and conditions so indicated may be outlined as follows:

*Empyema:* G-line absent. Density equal or slightly increased (reduced?).

*Polypoid:* G-line absent. Density increased.

*Vacuum:* G-line lessened. Density equal or increased.

*Hyperplasia:* G-line lessened and broadened. Density equal or slightly increased.

*Osteoplasia:* G-line broadened but not lessened. Density slightly increased.

#### SUMMARY

1. In the presence of signs and symptoms of focal infection, routine roentgen examination of the nasal sinuses is of equal importance to that of the teeth.

2. Sphenoidal pathology is as common as pathology of the other sinuses and is usually overlooked.

3. Examination of the sphenoids by the Granger method is as simple as that of the frontals and maxillaries and the interpretation of findings no more difficult.

4. A negative rhinological examination is not sufficient to rule out sinus pathology.

5. The Granger method must be followed in detail to obtain results.

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# THE ETHMOIDAL AND SPHENOIDAL SINUSES AS SOURCES OF FOCAL INFECTION<sup>1</sup>

By W. D. SANSUM, M.D., SANTA BARBARA, CALIFORNIA

THE ethmoidal and sphenoidal sinuses are common sources of focal infection. The great majority of the patients in this series had symptoms which were most probably due to some foci of infection. They had been seen by one or more physicians who had either failed to consider such sources, or the usual roentgenographic technic had failed to reveal any pathology. The diagnosis of frontal and maxillary sinus disease by the ordinary methods is usually successful. We believe that disease of the ethmoidal and sphenoidal sinuses is often overlooked, and that the significance of these as sources of focal infection is not fully appreciated. In all of our cases the reports of the roentgenologist were confirmed by competent rhinologists, while adequate treatment resulted in marked improvement and oftentimes radical cures. If any error was made, the rhinologist usually found more pathology than the roentgenologist. The table which follows shows the chief complaints for which the investigations were made.

Chronic arthritis.....	38 cases
Chronic parenchymatous nephritis .....	16 cases
Neuritis .....	17 cases
Migraine .....	10 cases
Chronic low grade fever usually associated with loss of appetite and malnutrition.....	7 cases
Peptic ulcer.....	4 cases
Lumbago .....	4 cases
Bronchial asthma.....	2 cases
Malnutrition .....	2 cases
Myocarditis .....	2 cases

Arterial hypertension in young people .....	2 cases
Chronic bronchitis.....	1 case
Epilepsy .....	1 case
Cervical adenitis.....	1 case
Catarrhal jaundice.....	1 case
Chronic head cold.....	1 case
—	109 cases

The frequency of involvement of one or more of the nasal sinuses is shown in the following table:

Sphenoidal .....	99 instances
Frontal .....	38 instances
Ethmoidal .....	24 instances
Maxillary .....	17 instances

The table which follows shows the types of lesions found in the sphenoidal sinuses and their relative frequency.

Hyperplasia	
Bilateral .....	20
Right .....	25
Left .....	18
Empyema	
Bilateral .....	5
Right .....	13
Left .....	12
Sinusitis	
Bilateral .....	5
Right .....	6
Left .....	3
Polypoid degeneration	
Bilateral .....	6
Right .....	4
Left .....	4
Vacuum	
Bilateral .....	1
Right .....	3
Left .....	3

<sup>1</sup>From the Potter Metabolic Clinic, Santa Barbara Cottage Hospital, Santa Barbara, California. Read by Dr. H. J. Ullmann before the Radiological Society of North America, at Milwaukee, Dec. 2, 1926.



A few typical case reports will serve to illustrate the more common lesions and the results obtained from treatment.

*Case 1, Chronic arthritis.*—Miss G., aged 60, came to my office August 11, 1925, complaining of an increasing amount of generalized arthritis. She was in constant pain, even while quiet, had considerable difficulty in arising from and sitting down in a chair, and could walk only slowly and painfully with the assistance of a cane. Her tonsils and a number of infected teeth had been removed in 1919 because of a mild attack of arthritis. This was followed by complete recovery. In February, 1924, she had a second attack of arthritis, involving especially the right arm, from which she also recovered. In February, 1925, she experienced a third attack, which involved practically all the joints of the body. At that time a careful search for foci of infection was made and none was found. Believing that the infection might have come from the colon, high colonic flushings were given several times per week, but the arthritis grew progressively worse. When examined by me her tonsils were absent, all teeth present were vital, and Dr. H. J. Ullmann's roentgenographic report showed a bilateral sphenoidal empyema.

She was referred to Dr. H. J. Profant, who found a slight amount of dried purulent material adherent to the posterior end of the middle turbinate and purulent material about the sphenoidal ostii, which was increased after sounding the ostii by the naso-pharyngoscope. Irrigation of this region revealed purulent material. Daily local treatments gave improvement in two weeks' time, and then the treatment was continued twice a week for two months. The left sphenoid responded in seven weeks and the right in ten. Immediately following the first treatment there was an increase in her arthritis which soon subsided. Two months later she was able to walk without

a cane and there was much less pain and swelling in the joints. This improvement continued until July, 1926, when there was a slight exacerbation. Roentgenograms at that time showed a bilateral sphenoidal hyperplasia, thus proving that sphenoidal empyema can be relieved without a radical operation. Treatment again brought about marked improvement.

*Case 2, Neuritis.*—Mrs. S., aged 55, entered the hospital September 25, 1926, complaining of a mild hypertension and an increasing amount of neuritis involving both shoulders and extending up the back of the neck. Her tonsils had been removed and all of her teeth were vital. Roentgenograms of her sinuses had been taken and no pathology found. New films were taken by Dr. H. J. Ullmann with the Granger technic, and no evidence of any definite pathology was reported. Despite the fact that no pathology was seen in the roentgenographic examination and because of her clinical symptoms, she was referred to Dr. G. S. Wells, who found the nasal septum deflected high to the right and low to the left. Both middle turbinates showed a polypoid degeneration posteriorly but more marked on the right. This is the only instance in our whole series where roentgenograms showed no pathology but where pathology was found. Following nasal operation and treatment, the patient's symptoms of neuritis entirely disappeared.

*Case 3, Chronic parenchymatous nephritis.*—Master W., aged 15, a sickly appearing boy, was brought to my office May 21, 1926, with a history of albumin in his urine at examinations made one and three years previously. He had never been well and strong. His tonsils had been enucleated and adenoids removed at four years of age because of chronic bronchitis. His teeth showed no pathology. He was nineteen pounds underweight. His urine contained a 2 mm. ring of albumin, with numerous

hyalin casts. Red cells, 4,300,000; white cells, 10,600; hemoglobin, 85 per cent Dare; temperature 99.2° F. Dr. H. J. Ullmann reported a bilateral anterior ethmoidal sinusitis, bilateral sphenoidal empyema, with a question of polypoid degeneration on the right and of bilateral frontal sinusitis. The patient was referred to Dr. G. S. Wells. Direct examination showed no discharge from the sphenoids or evidence of recent discharge, but a thickening of the anterior ends of the middle turbinates, both right and left, with mucous discharge from both frontal and anterior ethmoids. I examined this boy again on August 11 and on November 16, and on neither occasion were albumin or casts found in the urine. He had gained to a normal weight, had no fever, and appeared to be cured.

*Case 4, Chronic parenchymatous nephritis.*—Mr. M., aged 61, entered the hospital March 14, 1926, with a marked edema of his lower extremities, which had been gradually increasing for ten months. His urine contained large amounts of albumin and numerous casts. His tonsils had been removed in November, 1925, but he had many carious teeth. Roentgenograms showed a bilateral sphenoidal hyperplasia. He was advised to have all of his teeth removed and the nasal sinuses treated. He preferred to have this done at his home in Los Angeles, and left the hospital. He returned to the hospital June 24, 1926, with more edema than before. There was considerable fluid in the abdomen, the liver was slightly enlarged, and there was considerable fluid in both lungs. He had had all of his teeth removed. His rhinologist had assured him that there was no pathology warranting treatment of his sinuses. Red cells, 3,480,000; white cells, 15,600; hemoglobin, 65 per cent Dare; phenolsulphonaphthalein 55 per cent. His family had been given a grave prognosis. He was being treated periodically by very drastic diu-

retics. He was referred to Dr. P. C. Means, who found that his tonsils were out clean but the back of the pharynx was inflamed and had the common glazed appearance. His septum was moderately deflected on both sides and the upper part thickened. The turbinates were very edematous, easily shrinking, very sensitive to manipulation, which caused violent sneezing. No pus was seen at any time nor was any obtained by suction. By the third week of treatment the turbinates were less swollen all of the time; the sneezing and watery discharge were very much lessened; headaches were only occasional, and the cough which had kept him awake at night unless he was given opiates, was rarely troublesome. The edema of the legs was all gone and he looked and acted like a different man. The same treatment was continued until September 29, a little over three months, and there was steady improvement in the appearance and symptoms in the nose.

Commenting on this case, Dr. Means said: "Looking back at this case I am satisfied that the symptoms and appearance in the nose called for some treatment, and might perhaps have led to a suspicion of sinusitis. Some would have interpreted the films as sufficient negative evidence as to a focus of infection. However, I am sure that until recently I would not have felt justified in giving such a patient over forty treatments. But the marked relief of the distressing local conditions and the help this treatment seemed to exert on his cardio-renal disease, not only justifies it but makes it imperative that we use more care in tracing hidden infections and treat with patient persistence all suspicious areas."

At the present time the patient has gained in weight from 110 to 135 pounds. A part of the time his urine is entirely free from albumin, while at other times—and especially following strenuous activity—only a trace of albumin is found.

*Case 5, Migraine.*—Mrs. W., aged 48, entered the hospital on January 3, 1926, complaining especially of headaches, which she had had for twenty-five years. The physical examination was essentially negative except for the sinus condition. Dr. H. J. Ullmann's roentgenographic examination showed a right anterior ethmoiditis, hyperplasia of the mucous membrane of the right maxillary sinus, and a bilateral sphenoidal hyperplasia. She was referred to Dr. H. J. Profant, who found pus present in the right middle meatus and a hyperplasia of the mucous membrane, slight but definite in the posterior meati and olfactory fissures. The mucous membranes of the posterior ends of the turbinates showed a slight hypertrophy. The right maxillary sinus was dull to transillumination and the naso-pharyngoscope showed a hyperplasia of the mucous membrane posteriorly. Treatment of the sinuses resulted in marked relief of the patient's headaches.

*Case 6, Malnutrition, associated with low grade fever.*—Master K., aged 15, entered the hospital on June 7, 1926. He was 26 pounds under weight and had no appetite. Red cells, 4,350,000; white cells, 5,600; hemoglobin, 84 per cent Dare; temperature, 99.2° F. A careful search revealed no evidences of such chronic infections as tuberculosis or malaria. He had always been a sickly child. His adenoids had been removed when he was 10 months of age and his tonsils enucleated when he was 19 months of age. Dr. H. J. Ullmann reported a left frontal sinusitis and a question of osteoplastic change of the right sphenoid. The patient was first referred to a rhinologist, who failed to agree that there was sufficient pathology in his sinuses to account for his toxic condition, associated with a constant low grade fever. He was then referred to Dr. G. S. Wells, who found the septum deflected to the left high and to the right low, with a hyperplasia of

all the nasal mucosa. There was a marked thickening of the left posterior pillar, showing a long continued discharge from the sphenoidal region. There were mucous secretions from beneath the anterior ends of both the middle turbinates. Following treatment, the patient's fever disappeared and he has since gained 14 pounds in weight. The sinuses are not yet clear and treatment is being continued.

*Case 7, Recurrent peptic ulcer.*—Mr. B., aged 26, came to my office July 27, 1926, complaining of stomach distress which occurred before meals and during the night and which was relieved by the taking of food and soda. He had had stomach trouble for ten years. In 1918, a diagnosis of peptic ulcer was made from symptoms, and ulcer treatment appeared to cure the condition. The symptoms recurred in 1923 and a positive diagnosis of peptic ulcer was made from roentgenograms. His tonsils were then removed and again ulcer management appeared to cure the condition. When seen by me Dr. H. J. Ullmann reported a lesion of the duodenum, an empyema of the right sphenoid, and a hyperplasia of the left sphenoid. The patient was again advised to resume ulcer management and was referred to Dr. G. S. Wells for sinus treatment. Dr. Wells found a septum markedly deflected low to the left and high to the right, preventing aëration of the right sphenoidal area. The right inferior turbinate was markedly thickened and a muco-purulent discharge hung from the sphenoidal region. The discharge from the sphenoidal region cleared in about six weeks. The patient is now entirely free from symptoms of ulcer, even when taking a general diet. Roentgenograms will be made to check the duodenal lesion.

*Case 8, Lumbago.*—Mr. D., aged 40, entered the hospital October 24, 1925, complaining of a severe lumbago which came on suddenly following exposure while

swimming. He seemed to have a head cold. In the past, he had had a septum operation to promote sinus drainage and his tonsils had been removed several years previously because of lumbago. This had resulted in a cure. At that time he had also been advised to live in a high altitude with a low humidity. He had been in the hospital during the previous August, when he was treated for Raynaud's disease and malnutrition. At that time and because of his malnutrition, which was later found to be due to an achylia, roentgenograms of his sinuses were taken, which showed a question of chronic sphenoidal sinusitis. Sinus treatment was not advised at that time because of a lack of systemic symptoms. With the onset of his attack of lumbago, he was referred to Dr. H. J. Profant, who found a slight amount of pus present in the middle, superior meati and olfactory fissure, with mucous membrane hypertrophy throughout, showing a chronic condition. There was

also a hypertrophy of the posterior ends of the turbinates and a hyperplasia, most marked in the posterior ethmoidal and sphenoidal areas. Treatment was given at intervals because of the long standing chronic condition. As soon as the treatment was well under way the lumbago entirely disappeared.

#### SUMMARY AND CONCLUSIONS

All will agree that chronic foci of infection, as emphasized by Dr. Frank Billings and Dr. E. C. Rosenow, may very well be the cause of the conditions discussed in this paper. The fact that foci of infection have not always been found in patients afflicted with chronic arthritis and other conditions has led some men to believe that some of these diseases might not be due to the usual foci of infection. It seems to us that Dr. Granger's technic has added much to our knowledge, especially of chronic ethmoidal and sphenoidal disease.



## THE SURGICAL DIAGNOSIS OF PARANASAL SINUS DISEASE<sup>1</sup>

By J. R. HUME, M.D., NEW ORLEANS, LOUISIANA

THE diagnosis and treatment of paranasal sinus disease encompasses a field of so extensive area, that, in this paper, I propose to generalize my remarks on the major sinuses, with a more detailed discussion of some recent observations on the ethmoid cells and sphenoidal sinus.

Our improved armamentarium and technic for the diagnosis of maxillary sinus disease have made comparatively easy the diagnosis of conditions in this cavity—especially is this true in those attended with discharge. A routine examination should include a careful history; nasopharyngoscopic examination to determine location, character, and quantity of discharge in the nasal cavity, and macroscopic and microscopic studies of its character, the specimen to be obtained from washings through the ostium maxillare or puncture through the naso-antral wall. Careful use of the above procedure, supplemented by radiographic findings, with or without lipiodol, should in most instances allow us to determine the existent pathology.

In frontal sinus disease much the same procedure is followed, with little more difficulty than is encountered in disease of the maxillary.

So much work has been done—and done so well—in the diagnosis and treatment of these two major sinuses that I am going to direct your attention to the more remote and less well understood diseases of the post-ethmoid cells and sphenoid sinus—that type of case referred to in the literature as *hyperplastic*.

The multiplicity of symptoms confronting the earlier workers was confusing, and only of late have detailed pathological

studies made clear the cause of this erstwhile perplexing problem. Dr. Sluder's work on hyperplastic sphenoiditis leaves but little to add in the way of description. His discussion of the phenomena presented by disease in this region is excellent, and many of us are indebted to him for the inspiration to further study.

Recent pathological studies have proven that the changes taking place in the ethmoidal labyrinth and sphenoidal sinus are co-existent, and hence the following is a discussion of hyperplastic ethmo-sphenoiditis.

The microscopic changes noted in specimens taken from sufferers from disease in this region involve all structures from epithelium to bone. McMahon, in a recent report of a series of 75 cases, found thickening, sloughing, polypoid degeneration, and metaplasia of the epithelium; thickening of the basement membrane and periosteum, with the tunica propria presenting edema, round-cell infiltration, dilatation or compression of glands, and thickening of blood vessel walls. In the bone he found both osteoblastic and osteoclastic activity, as well as fibrosis, hyperostosis, osteomalacia, and necrosis. Changes of this type occurring in a region associated with such important nerve structures could hardly fail to produce a varied symptomatology.

The close proximity of Meckel's ganglion, with its widely distributed fibers, is responsible for the predominating symptom of disease in this region—pain. This pain, frequently intense, radiates to the frontal, parietal, and occipital regions, and often into the neck and shoulders. Co-existent with pain we may have post-nasal discharge, intra- and extra-ocular eye symptoms, vertigo, diminished hearing, evidence of existent foci of infection producing arthritis,

<sup>1</sup>Read before the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 29-Dec. 4, 1926.

asthma, myalgias, etc. Hardly any symptom occurring about the head but has been attributed directly or indirectly to pathology in this region.

Strange as it may seem, with such a formidable array of symptoms, this region presents to the eye of the observer often but slight deviation from the normal appearance.

With the nasopharyngoscope we may be able to observe hyperplastic changes in the posterior tips of the inferior and middle turbinates, but do not consider such a finding of great value, as the same may be noted in patients presenting no symptoms whatever. Deviations of the septum, however, are usually present and are doubtless of great importance as an etiologic factor—also, they must receive consideration in determining the proper surgical procedure. Given a patient suffering great pain, with one or more of the associated symptoms, presenting an inferior and middle fossa of the nose relatively free from evidence of disease, the rhinologist is dependent for further data upon the radiologist and the ophthalmologist to determine color acuity and changes in visual fields. It has proven almost invariably true that those cases showing a diminished color acuity and concentrically contracted fields for form and color have returned from the radiologist with a diagnosis of hyperplastic changes in the sphenoid. Frequently, however, the radiologist finds evidence of hyperplastic changes, while the ophthalmologist finds a normal or only a very slightly contracted visual field.

It has also been observed that a patient of this type invariably has marked deviations of the septum. The radiologic changes noted are a direct result of faulty ventilation. When both the above-mentioned consultants report positive findings ethmo-sphenoidectomy is recommended. Where the radiologist reports positive and

the oculist negative, a submucous resection of the septum and such other procedures as may be necessary to promote proper ventilation and relieve intra-nasal pressure are advised.

I wish to present briefly two case histories that fairly typify the method of diagnosis and results of treatment occurring in our series of more than sixty cases recorded during the past two years.

Case 1, Mr. C. H. C., traveling salesman, age 44, presented himself for examination in July, 1925, with a history of intense headaches at intervals for the past ten years, of gradually increasing frequency. For the month preceding he had been unable to continue his work. Routine otolaryngological examination showed evidence of but slight pathology, a septal deviation to the right alone being noted. The patient was referred to Dr. M. E. Brown for ophthalmological study. Dr. Brown reported: "Slight error of refraction; fundus normal; visual fields show contraction for form and color." Dr. Amédée Granger reported the radiological findings as follows: "Chronic sphenoiditis and posterior ethmoiditis, with hyperplastic changes most marked on the right side." A bilateral ethmo-sphenoidectomy was done on July 14, 1925. Patient made an uneventful recovery and has remained entirely free from symptoms.

Case 2, Miss A. G. A., trained nurse, age 28, was first seen in January, 1925. She gave a history of recurrent headaches for the past twelve years, and pain—beginning in the frontal region and gradually extending to the parietal and occipital. Temporary relief was obtained by cocainization of Meckel's ganglion. Painstaking examinations of the nose and sinuses by the usual methods failed to reveal anything of diagnostic value. The patient was referred to Dr. M. E. Brown for ophthalmological survey. He reported: "Visual acuity nor-

mal; fundus negative; visual fields concentrically contracted for both form and color." Dr. Leon J. Menville made a radiological examination. He reported: "Both sphenoids show thickening of the Granger line."

On August 6, 1925, a bilateral ethmo-sphenoidectomy was performed. The patient suffered considerable pain for three days following the operative procedure; otherwise she made an uneventful recovery. She has gained considerable weight and there has been no recurrence of the pain.

Dr. Brown has reported the visual fields of these illustrative cases, which demonstrate very clearly the rapidity with which they return to normal after operation.

The conclusions arrived at by observation are—

- (1) That extensive pathologic changes

may occur in this region without being markedly visible to the eye of the observer.

(2) In those cases reported hyperplastic sphenoiditis by the radiologist and confirmed by contraction of visual fields for form and color, ethmo-sphenoidectomy is indicated.

(3) In cases reported positive by the radiologist and negative as regards visual fields, submucous resection or such other work as may be necessary to promote ventilation and drainage to the region is advisable.

(4) Proper operative procedure in a high percentage of cases gives early relief of symptoms and return to normal of the visual fields, as shown by recorded cases.

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# OCULAR MANIFESTATIONS OF DISEASES OF THE PARANASAL SINUSES<sup>1</sup>

By MARION EARLE BROWN, M.D., NEW ORLEANS, LOUISIANA

WHEN making a survey of the eyes of patients who suffer from paranasal sinus diseases the ophthalmologist should study—

cele, a distention by mucus, and empyema, of pus. At the upper and inner angle of the orbit a tumor can be palpated, accompanied by sensitiveness upon pressure over the

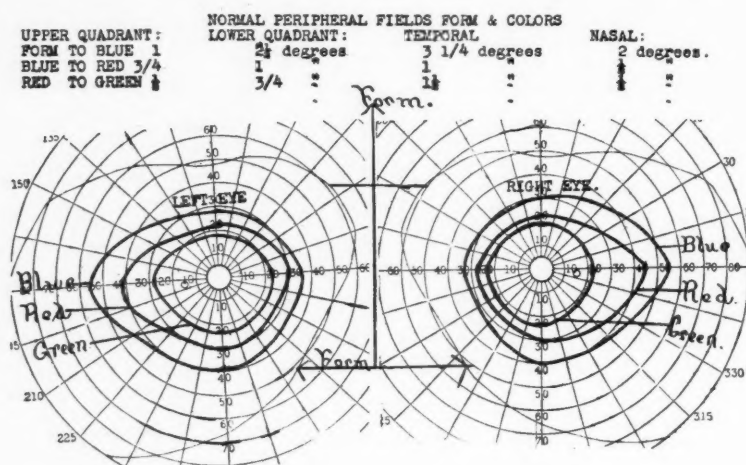


Fig. 1. Normal peripheral fields for form and colors, showing the relative positions of each.

1. Color perception, central and peripheral;
2. Color acuity, central;
3. Visual acuity, central;
4. Campimetric measurements of the blind spot;
5. Peripheral field studies of form and colors;
6. Refractive errors;
7. Derangements of binocular vision;
8. Scotoma with the tangent screen;
9. Radiographs.

frontal bones (Ewing's sign), tenderness at the attachment of the pulley of the superior oblique muscle, with headache and supra-orbital pain. There are diplopia and epiphora, with an enlargement of the blind spot of Mariotte. Osteoma also causes a bulging of the upper and inner angle of the orbit, which is dense, painless, and of slow growth, being readily differentiated from mucocoele and empyema by radiological studies.

## ETHMOIDS

### FRONTAL SINUS

Among the diseases of the frontal sinus presenting ocular manifestations are muco-

Knapp's retention cyst and mucocoele of the ethmoid are synonymous. The lesion appears in the upper and inner angle of the orbit, above and behind the internal canthal ligament, displacing the eyeball downward

<sup>1</sup>Presented before the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 29-Dec. 4, 1926.



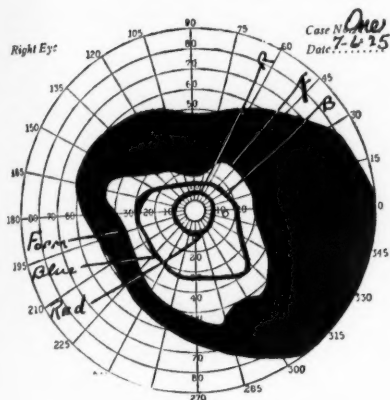


Fig. 2. Right eye. Demonstrates a concentric contraction for form, plus unequal defects, with contractions of blue and red, green having been completely lost.

and outward, and is differentiated from exostosis by an exploratory incision and the X-ray, preferably the latter. In ethmoiditis, one may find tumefaction of the inner third of the lid, diplopia, epiphora, faulty movements of the eyeball, and severe pain (ethmoidal syndrome). In posterior ethmoiditis of the sclerotic type, the pain is perhaps more severe (Meckel's ganglia syndrome), the threshold for color acuity is diminished, the blind spot of Mariotte presents a concentric enlargement, the peripheral visual fields are contracted for form and color, central vision is diminished, and

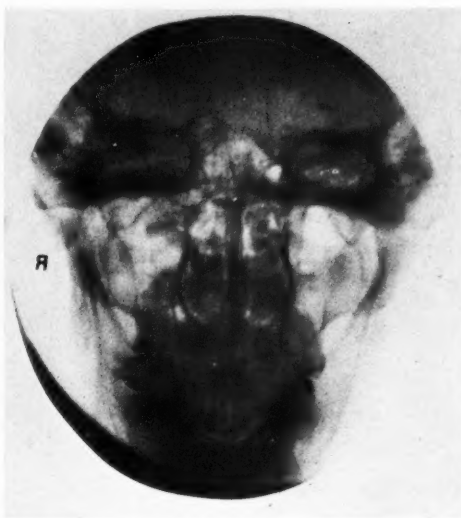


Fig. 4. Radiograph, reported by Dr. Granger as a chronic sphenoiditis and posterior ethmoiditis, with hyperplastic changes on the right side.

there is a central scotoma, differentiating the disease from sphenoiditis. The otolaryngologist generally makes the diagnosis, the radiologist concurring.

#### ANTRUM

When the antrum is the seat of the disease manifold symptoms are presented—

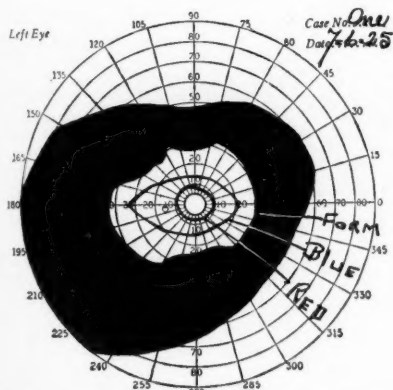


Fig. 3. Left eye. Similar to Figure 2, except that the contractions are greater.

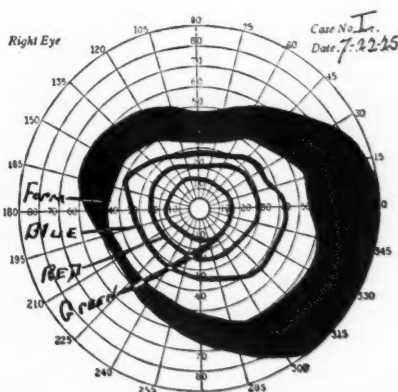


Fig. 5. Same case as Figure 4. Peripheral field studies 16 days following ethmosphenoidectomy, showing remarkable gain in peripheral vision. Note that green has returned to the field.

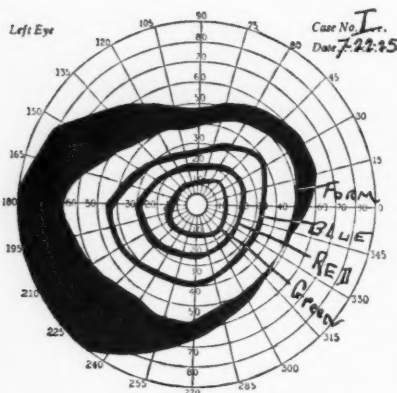


Fig. 6. Same as the fellow eye, Figure 5.

edema of the lids, chemosis of the conjunctiva, edema of the optic nerve, distended blood vessels (veins), and affections of the lacrimal apparatus. The disease is generally diagnosed by the otolaryngologist and the radiologist.

Foreign bodies in the paranasal sinuses may have entered through the orbit, or directly through the anterior wall; for instance, shot, shrapnel, missiles from small arms or machine guns, flying particles due



Fig. 7. Radiograph of case of chronic sphenoiditis

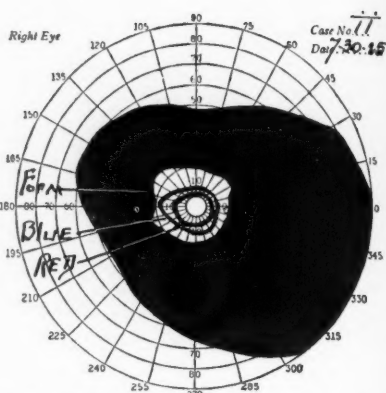


Fig. 8. Right eye shows contractions of form down to the twentieth meridian; blue and red are commensurate with form; green is completely gone.

to industrial traumatism or explosions, and possible accidental trauma during surgical operations. The diagnosis is essentially dependent upon the X-ray.

Orbital abscess develops from pus escaping through the os planum into the orbital cavity. Pansinusitis of the anterior group—the posterior ethmoids exclusive of the sphenoid—presents a downward and outward displacement of the eyeball, diplopia, epiphora, and a tumor mass in the upper and inner angle of the orbit. In a recent case the radiograph demonstrated a rupture through the anterior ethmoid into the orbit,

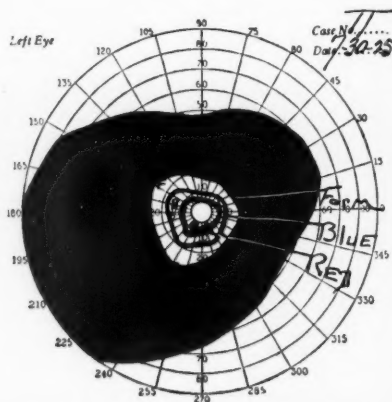


Fig. 9. Left eye, same as right eye, Figure 8.

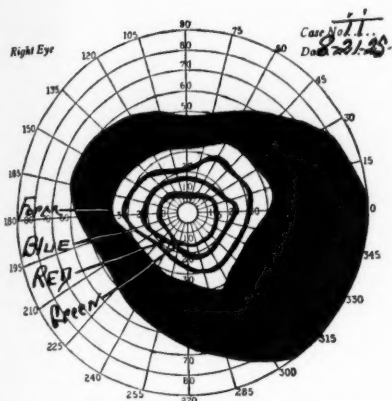


Fig. 10. Showing the amount of peripheral vision gained 22 days following ethmosphenoidectomy. Again we see the return of green to the field.

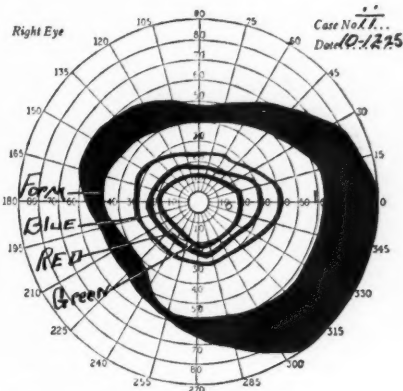


Fig. 12. Showing further gain in peripheral vision, which is nearly normal. These observations were made 52 days after operation.

with complete destruction of the floor of the frontal sinus. The X-ray findings in this case were confirmed by surgery in the hands of Dr. Val. H. Fuchs, of New Orleans.

#### ACUTE SPHENOIDITIS

We learn from the otolaryngologist that every case of posterior ethmoiditis is truly a potential sphenoiditis, described by Hajek as "No man's land." Patients suffering from this disease experience severe pain (sphenoidal syndrome), which may be bilateral or unilateral, generally commencing

upon the side of the sinus involved, and gradually becoming bilateral. The pain is described as originating within the eyeball, radiating to the orbital region and extending to the frontal, then to the parietal in the center of the head down to the auricular or mastoid region and finally terminating in the nuchal region. The symptom complex is produced by pressure upon the ophthalmic division of the fifth cranial nerve, which is in close proximity to the lateral surface of the sphenoidal body. Esotropia is present in varying degrees. There is excessive accommodation (Koenigshofer's sign), Van

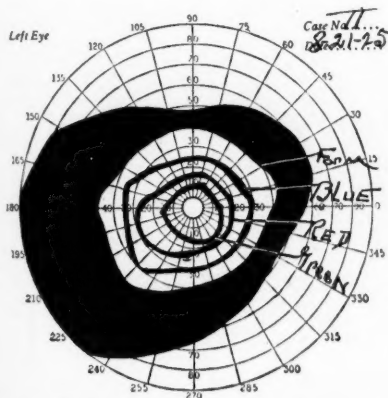


Fig. 11. Same as the fellow eye, Figure 10.

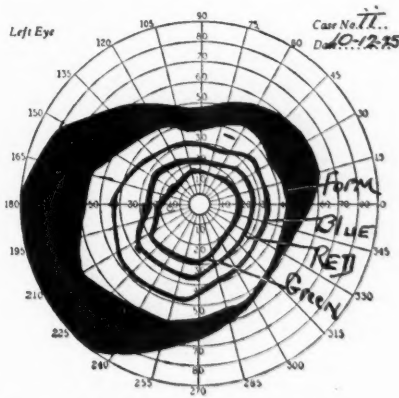


Fig. 13. The fellow eye to Figure 12.

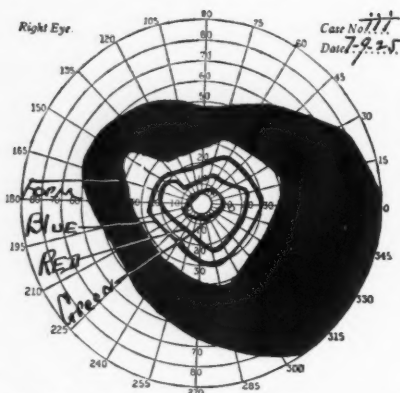


Fig. 14. Showing a contraction for form and colors.

der Hoeve's sign, and enlargement of the blind spot. Central vision is diminished, color acuity is diminished, peripheral fields are contracted (concentric) both for form and colors, optic neuritis is present, choked disc produces partial or complete blindness, and, finally, atrophy of the optic nerve ensues. We expect the radiologist to concur in our findings in differentiating this disease from ethmoiditis and the other types of sphenoiditis.

#### SPHENOIDITIS (CHRONIC PURULENT)

When the disease progresses to this stage all symptoms of the acute type are present,

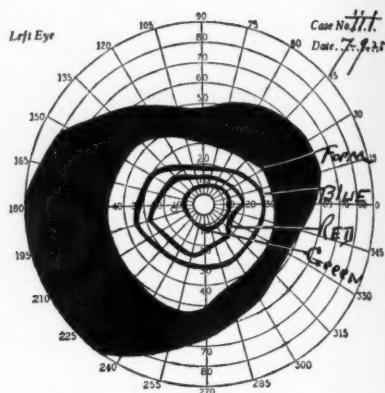


Fig. 15. Showing a contraction for form and colors.

with the addition of pressure phenomena from distended sinuses, rupture of infected material into the orbital cavity, extension of the inflammation, and, finally, bone necrosis. Optic neuritis is generally the result, with the atrophies that must necessarily follow.

There are three forms of optic neuritis: (1) Diffuse interstitial neuritis; (2) axial neuritis; (3) perineuritis. Central vision is diminished in Types 1 and 2 and not affected in Type 3 (Peter). The otolaryngologist and the ophthalmologist generally recognize the disease, the radiologist concurring.

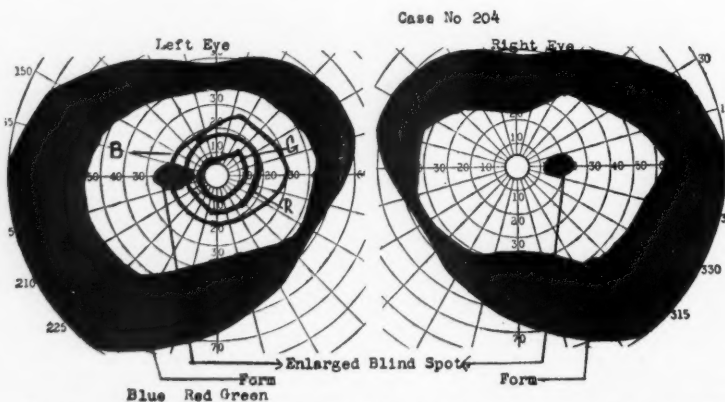


Fig. 16. Right eye. Presenting a peripheral field with a concentric enlargement of the blind spot, contractions of the form field, with complete color amaurosis. The left eye shows a concentric enlargement of the blind spot greater than the right eye, also a contracted field for form, with colors contracted out of proportion to that for form.



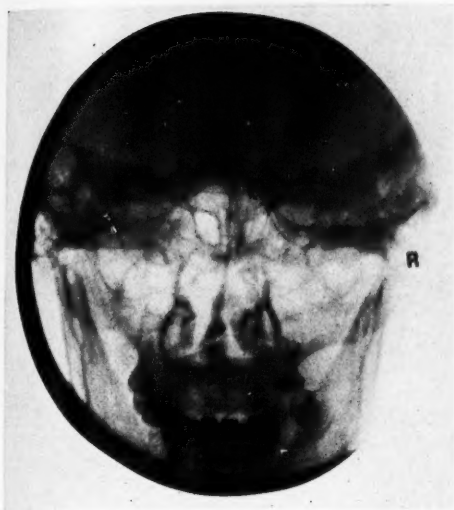


Fig. 17. Radiograph showing chronic hyperplastic sphenothmoiditis on the right side.

#### SPHENOIDITIS (HYPERPLASTIC TYPE)

From this type, usually the most difficult to diagnose (impossible before the publication of the Granger contribution), we may now expect the best results. The development of the color acuity test, the demonstration of an invasion of the optic nerve, the studies of Peter with the perimeter, and the recently developed technic of ethmo-sphenoidectomy are measures for its relief.

Patients suffering from this disease complain of severe headaches, from which they can obtain only temporary relief from drugs. The duration is extended over a long period. One patient recently stated that she had suffered from headaches from her earliest memory impressions. The symptom complex is the classic sphenoidal syndrome.

Esotropia is present from 10 to 20 degrees on the affected side; central vision is normal; color perception is normal; the color acuity threshold is markedly diminished, and the peripheral fields are concentrically contracted, both for form and colors—even as low as the tenth meridian in some cases—simulating a field of optic atrophy. Generally both eyes show a contraction of the field, the greatest contractures being on the affected side in unilateral sphenoiditis and on both sides in bilateral sphenoiditis. There is no demonstrable pathology in the fundi. There is a perineuritis, the result of congested blood vessels; thickening of the epithelium and basement membrane; edema; fibrosis; thickening of blood vessel walls and fibrosis of the tunica propria, and thickening of the periosteum. There are hyperemia and hyperplasia of the mucosa, compressing the optic nerve within the op-

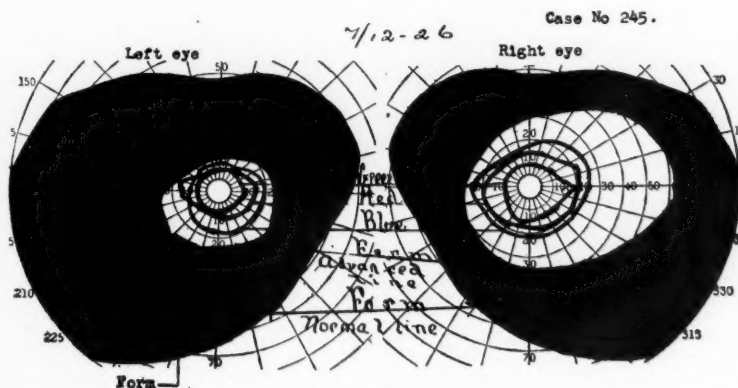


Fig. 18. Right eye shows a contraction for form and colors. Left eye shows a similar contraction, but to a greater degree, as low as the twentieth meridian for form, colors being commensurate with form.



Fig. 19. Same case as Figure 18, showing marked visual gain when studied 97 days following ethmosphenoidectomy.

tical canal, with bone changes which produce a break in the conduction of the peripheral fibers of the optic nerve and restrict the function of the percipient screen, as manifested by contraction of the peripheral visual fields for form and colors with no influence upon central vision for form, but with a diminished color acuity threshold for red, green, and blue. As a result of this

pressure a local inflammatory process is set up within the optic canal which will terminate in diffuse optic neuritis and the atrophies that follow, with complete blindness as the terminal result.

In a series of 27 cases studied for a symposium on sphenoiditis of which the author was the chairman, held recently by the Ophthalmological, Rhinological and Otolaryngological Society of New Orleans, the radiologist confirmed each diagnosis without a history. The sphenoiditis occurred upon the side of greatest contracture of the peripheral fields, coinciding with the one producing the symptoms. This was later confirmed by surgery, the results of which have been most encouraging. They conform to the statistics of McMahon, who reports the percentage of improved and cured cases to be 74.3.

In this type of sphenoiditis, examinations made by the otolaryngologist are negative, and we must necessarily look to the radiologist, with his studies of the Granger line, for confirmation of our diagnosis. The difference in density of the two sphenoid regions, shown on the radiograph, is negligible, when present at all.

The field studies presented with this pa-



Fig. 20. Radiograph showing chronic sphenoiditis on the left side.

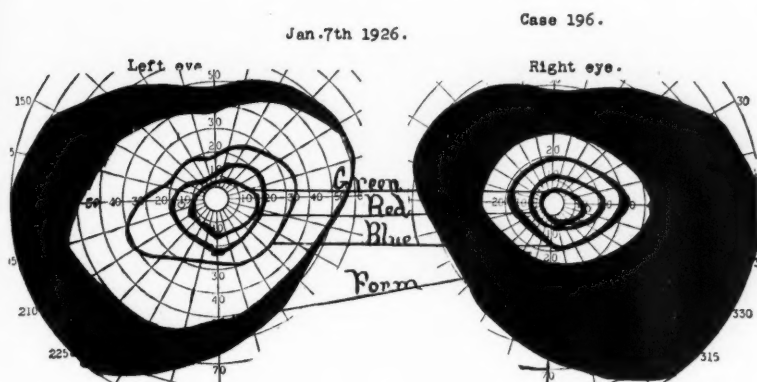


Fig. 21. Both eyes show contractions for form and colors, the greatest contractions being on the right side.

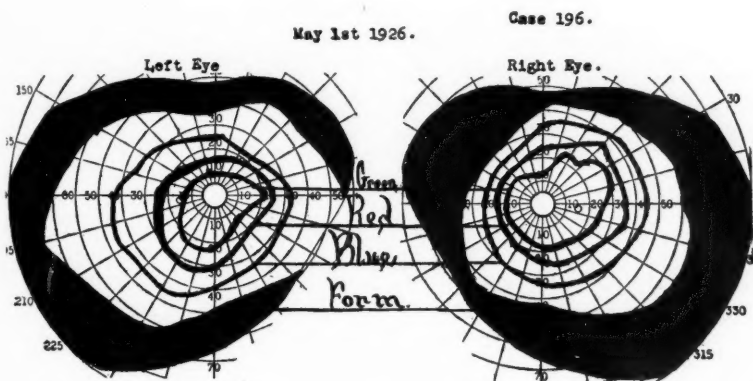


Fig. 22. Same case as Figure 21; studies made two weeks following surgery. Note gain in peripheral vision.

per were made by my surgical assistant, Miss Octavia Prejean.

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Fig. 23. Radiograph showing hyperplastic sphenoiditis on the right side.

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#### DISCUSSION

DR. F. H. HAESSLER (Milwaukee): To the oculist the most interesting thing in the symposium has been Dr. Brown's presentation of his method of testing the central visual acuity for colors. This is an absolutely simple test; in fact, one of the utmost simplicity. One could find nothing simpler than merely showing a patient four colored discs and asking him to name them, yet it is capable of giving tremendous information. The oculist, if he does his whole duty to the patient, must at least tell him whether the visual apparatus is normal or not normal, and yet the visual apparatus consists not only of the eye but the nervous mechanism that connects the eye to the occipital

cortex. We can examine the eye by looking at it, yet there are many lesions affecting the visual apparatus which have nothing whatever that one can see: one can look at the retina or at a very short piece of the optic nerve and can see nothing behind that. The only method at our command of determining whether or not the tract which connects the eye to the brain is normal, is to test its function. If the central vision is perfectly normal, the field may still be abnormal. A field, to have any value at all, must be taken with considerable accuracy, and that consumes a long time. I think we all must confess that we have slipped up merely because we have assumed the field to be normal when, as a matter of fact, if we had actually tested we should have found some lesion. With this test of Dr. Brown's we can learn, by merely showing four colors, that something is wrong. A color-blind person would fail on the test, but the test is not supposed to show that any definite thing is wrong. It is merely to weed out the normal from the abnormal. If this test works out as Dr. Brown has explained, we can at least find out, by very simple means, that the tract is normal or abnormal, and if we find something abnormal, then it does not take very much energy to take a field. However, all of us are somewhat discouraged in taking a field with great pains which we think will turn out normal in the end; but if we have some indication that we are going to find something abnormal which is distinctly worth while, we will go about taking any degree of pains to find the lesion.

I should like to ask Dr. Brown to say a few words about his test in multiple sclerosis. Of course, if we have a central scotoma, central vision is so much defective that the color test is unnecessary. On the other hand, it would be very interesting to see if an early multiple sclerosis could be picked up by this color test, because cer-



tainly a great many of the retrobulbar neuritis cases which are diagnosed as rhinogenic, and clear up with an operation on a sinus which does not have very much the matter with it, are multiple sclerosis which has not been diagnosed. The operation did not cure the thing; it merely cleared up by itself. Multiple sclerosis spontaneously undergoes change. I think a great many cases of eye disease which are treated by surgery in the nose, are expressions of multiple sclerosis which cleared merely because the nervous disease underwent a remission.

DR. G. HENRY MUNDT (Chicago): I am certain we have all enjoyed this symposium, and I am quite certain that one should do as Dr. Beck<sup>1</sup> did, that is, interject a little pessimism on the extreme enthusiasm which has been shown in some places. One thing that I want to say above everything else is that a roentgenogram of sinuses is part of rhinologic examination and is not a diagnostic procedure. Who shall interpret the roentgenogram? I am stimulated to say that because of a statement made by Dr. Brown. I think that the clinician should very largely interpret his own films. Doubtless there will be instances in which it would be advantageous to have the interpretation from a roentgenologist. That particularly would be true, I think, in the Granger line. However, there are other things besides density in roentgenograms which are very important. One must consider size and the development of sinuses if he is going to look at his films properly from the standpoint of rhinology.

On the whole, I agree with the statements in Dr. Sansum's paper, but I think one of the most optimistic I have heard is the last thing in his synopsis. He states that the roentgen diagnosis was proven by the rhinol-

ogist and the treatment resulted in marked benefit to every patient. I congratulate him, because I am certain that that is a more optimistic statement than most of us can make. Certainly I am stimulated to go back to Chicago and see some sphenoid diagnoses with roentgenograms, because they are difficult to get.

Because of what Dr. Ullmann said regarding the shortcomings of the rhinologist in sinus disease, I might stand here and say the same thing about the shortcomings of some roentgenologists. I call your attention particularly to the efforts made in certain reports—roentgen reports on intranasal conditions. Certainly one is hardly justified in making intranasal reports from roentgenograms. Transillumination was spoken of. I certainly feel that there is only one place where we may use transillumination in sinus affections with any degree of satisfaction, and that is in the maxillary. Now I speak the way I have about roentgenology because I can say, without any equivocation, that for well over ten years I have not operated on a nose that has not been roentgenographed before it was operated on, and I believe I have watched the thing with reasonable care.

DR. M. J. HUBENY (Chicago): I am another fellow from Chicago. I have known Dr. Beck for a long time, and he never sends me any work [Laughter]. I have known Dr. Mundt for a long time and he has one roentgenologist whom he likes better. What I mean is this: I know the men; I know their work and I admire the attitude they have taken. The symposium has been really a very instructive one—it reminds me very much of the American Medical Association. We have dealt with the subject from the clinical standpoint as well as from the roentgenological. I believe that the X-ray certainly has a definite limit. I am a little bit afraid to make a diagnosis

<sup>1</sup>Dr. Joseph Beck's discussion has not been received for publication.

to the men who come in for their head work, because they are just like Dr. Beck and Dr. Mundt—they "tell me where to head in," and they can read the films better than I can. A few years ago, through the direction of Dr. Cavanaugh, we did some X-ray work on sphenoids on a living person, making the films in different positions, posterior and anterior, intra-oral and vertical—submental and submental-vertical, and I was surprised to see where those sphenoids were located. I hoped that when Dr. Granger carried out this symposium, it was going to make me feel a little more certain about my step, but as a matter of fact I am just as confused as I ever was. With due credit to Dr. Granger, I think it requires special aptitude to do it, and I am going home to try it some more. I believe we should be cautioned by Dr. Mundt's remarks and by the remarks of Dr. Beck, because going into a patient's ethmoids and sphenoids indiscriminately is not a very nice thing to do.

DR. JOSEPH ASPRAY (Spokane, Washington): I am not from Chicago—I am from Spokane [Laughter]. I think that the seriousness of going into sphenoids and posterior ethmoids justifies all the help that we can get to make correct interpretations. For many years I have been doing sinus work, using a special technic in some instances, but in all of the work taking at least six views. This has been done since 1919 and we are still following the same technic, and I see no reason why we should limit it to a couple of views. I think that the anterior ethmoid, posterior ethmoid and sphenoid, all being superimposed on the frontal, which varies in its depth, density, and size, therefore make a very definite change in the density of the structures seen in the Granger technic. We need the regular frontal view for the frontals and anterior ethmoids, also a lateral; we need the Waters position to help out on the maxillary sinuses.

We also need the lateral to give us the anatomy, the density and size and construction of the sphenoid and posterior ethmoid; while the most valuable film in my experience for posterior ethmoid disease is the so-called modified Pfahler's technic, with the mouth cassette and film. We have modified his original technic by having the patient lie in a horizontal position on the table, a method which was described in a paper before the American Roentgen Society in 1924 and published in the December issue of their journal. I do think that the sphenoid is a very difficult thing to diagnose, and that we need more than one view to do it. The most interesting work I have seen from a diagnostic standpoint on the sphenoid and posterior ethmoid is the stereoscopic examination which has been done and described by Dr. Reaves, of North Carolina, who is showing this film with a radioscope in the commercial department of this meeting. It is the finest thing on sphenoids I have ever seen, without exception, and anybody interested in sphenoid disease certainly will be well repaid to have Dr. Reaves give him the technic and show him the results.

DR. AMEDEE GRANGER (New Orleans): I will attempt to clear away some of the difficulties in the interpretation of the radiographs of the paranasal sinuses made according to my method, as it would appear that I did not succeed in doing this to the extent that I had hoped in my preceding papers. First of all, two views and not one are made for the diagnosis of sphenoid pathology. Experience during the past four years has convinced me that the lateral view is of no value for making this diagnosis, although I realize and appreciate its value in determining the size of the sphenoid, the presence of adventitious septa, or extensions into the pterygoid process, and the presence and depth of the frontal sinuses; and when the patient goes to op-

eration the lateral view is essential to determine the distance from the anterior nasal spine to the anterior and posterior sphenoid walls, especially if a blunt curet or hand burr is to be used in the sphenoid.

When making the  $107^\circ$  angle radiograph it is absolutely necessary that the weight of the head should bear evenly on the superior maxilla and the glabella, as it is only so that a satisfactory diagnostic sphenoid film can be obtained. My experience has demonstrated that the vertical ray is much more easily centered than an oblique one, and that it should pass just below the external auditory canal on its way to the film. I must also insist that the head of the patient be inclined  $17^\circ$  from the perpendicular, making a total angle of  $107^\circ$ , and that the central ray be directed perpendicularly to the table. When the patient is placed properly with the head resting uniformly on the alveolar process (upper jaw), and the glabella (line uniting the two supra-orbital regions), a satisfactory radiograph is obtained, with the shadow of the petrous bones contained entirely within the orbits. I cannot insist too strongly upon the fact that this is *the criterion of a satisfactory sphenoid radiograph*. In such a film you will always see a curved line (G-line), which proceeds from just below the anterior clinoid process on one side, to a similar point below the anterior clinoid process on the other side, and which is formed by the floor of the optic groove. This line is the upper boundary of the sphenoid region. The "C-line," formed by the orbital plate of the frontal, is always seen in good films, continuous in the upper portion of the nares with the shadow of the superior turbinate, and proceeding outwardly as the upper margin of the orbits, forming the upper boundary of the ethmoid region. As the sphenoids are projected through the frontals it becomes necessary to know the condition of the latter, and for this reason

two radiographs are always made. The first one ( $107^\circ$  P.A. view) shows the sphenoid to the best advantage and dissociates it from the posterior ethmoids. The second ( $23^\circ$  angle P.A. view) shows the condition of the frontals, ethmoids, and maxillaries. By a careful and correlative study of these two views I have experienced no difficulty in diagnosing diseased conditions of the paranasal sinuses.

I have tried without success to find on these films a constant anatomical landmark, separating the anterior from the posterior group of ethmoid cells. It is odd that even the most intelligent patients, to whom the technic has been carefully explained, will for some reason or another rarely bear evenly on the upper jaw and the glabella. When the upper jaw makes better contact the curved "G-line" is not visualized, and in its stead we see a straight line formed by the posterior edge of the floor of the anterior cerebral fossa, and the shadow of the petrous bone extends below the inferior margin of the orbit, leaving the upper half of the orbit clear of shadows. The last observation is not only an indication that the position of the head was not correct, but it tells us what the fault was. On the other hand, when the distance between the "G-line" and the "C-line" is so diminished that not enough of the sphenoid region is seen for an interpretation to be made, the shadow of the petrous bone will be seen to extend beyond the upper border of the orbit, and in these cases the position was again faulty, the glabella having made better contact than the upper jaw did.

The same projection of anatomical structures will take place whether the head or the X-ray tube is tilted  $17^\circ$  to make the  $107^\circ$  angle radiograph, but in the latter instance, as the anterior wall of the sphenoid and not the "G-line," that portion of its upper wall formed by the optic groove, is the most dependent portion, pus or secre-

tions will flow down against it, and not against the "G-line" (optic groove), which remains visible, and we are thus deprived of the surest sign for the diagnosis of even a small amount of pus in the sphenoid. Hence my reason for insisting that the head be inclined  $17^\circ$  and not the tube. Very properly it might be asked, What happens to the "G-line" if the frontals are occluded by disease, or if they are not developed? It has been shown conclusively by experience and clinical observation that in these instances the "G-line" is still visible and the apparent increase in density of one or both sphenoid regions can be readily seen to be due to some other cause than pathology in the sphenoid, as this density is not confined to the boundaries of the sphenoid region.

Referring to the case mentioned by Dr. Ullmann in his excellent paper, I am forced to remind you of the very old dictum, "the exception proves the rule." In our experience with this method during the past four years these exceptions have been very few, certainly well under 10 per cent.

The Doctor quoted my statement that the diagnosis of empyema of the sphenoid sinus can be made whenever the "G-line" cannot be seen, and the density of the sphenoid region is not sufficient to indicate the presence of polyps. Because that line was visible on the radiograph of the case he reported, he interpreted that as meaning there was no pus in the sphenoid, and yet at operation pus was found. Experience has taught me that in the comparatively few instances when an unusual sphenoid wall produces a very thick and dense "G-line," the presence of pus or secretions in the sphenoid, will not be sufficient to obliterate that line, unless polyps are also present. But the presence of pus in the sphenoid in this case and similar cases can be diagnosed by the increased density of the sphenoid region, and when the pus is in one sphenoid only by the fact that the lower margin of the

"G-line" is not quite as sharply defined on the affected side. In the other group of exceptional cases where the "G-line" is very thin and hard to see by direct illumination, even on the healthy side, a vacuum condition of the sinus, without any pus or secretion, is sufficient to obliterate it.

I wish again to report the following case, which was of more than usual interest because, first, the "G-line" showed distinctly through the diseased frontal, and second, intrabuccal films showed the sphenoid opaque on one side—not because of any pathology in that sinus, but due to the complete occlusion of that naris by pus, detritus, and swollen mucous membrane. The patient was a white woman, admitted to the Charity Hospital with a temperature of  $104^\circ$ , very high leukocyte count, cellulitis of the left side of the face, and the left naris completely occluded. The clinical diagnosis was pansinusitis on the left side. The infection was believed to be present in all the sinuses, including the sphenoid on that side.

*Röntgen findings:* As the left sphenoid and ethmoids were densely opaque on the intrabuccal films the only interpretation possible from their reading was that these sinuses were diseased, but as the "G-line" showed distinctly through the diseased left frontal on the film made in my position, I excluded that sphenoid, and because that same line was less dense, and its lower border not so sharply defined on the right side, I made an interpretation of pansinusitis (except the sphenoid on the left side), and chronic sphenoiditis with hyperplasia on the right side. *Operative findings:* Pus in the left frontal, maxillary, and both groups of ethmoid cells, but no pus found in the left sphenoid, which was opened because it did not seem possible to the operator that with so much pus in the other sinuses and the occlusion of the naris, which interfered with drainage, that the sphenoid could have escaped infection. The right sphenoid was



opened, no pus was found, but its lining membrane was hyperplastic.

DR. BROWN (closing): We ask rhinologists to accept the interpretation of the densities and shadows cast upon the graph by the radiologist and to consult the ophthalmologist in cases of hyperplastic sphenoiditis, because these findings are the combined results of scientific study, and the other methods are based upon clinical symptoms, which of course are often unreliable.

With the advantages of Dr. Granger's contribution to radiology, the recently published studies with the color acuity test, and the behavior of the percipient screen both before and following surgery, it is possible not only to relieve the agony of upper-half headaches, but to prevent permanent blindness from atrophy of the optic nerves. We see unfortunates in our clinics at the Charity Hospital of New Orleans, permanently blind as a result of not only untreated, but undiagnosed, cases of hyperplastic sphenoiditis.

DR. ULLMANN (closing): The rhinologists' criticism we have just heard reminds me of our discussion with our rhinologists a year and more ago, before we had demonstrated the value of Dr. Granger's methods. Perhaps Dr. Beck does not find as many sphenoids as we do because they are not looked for by this method. I suggest this because of our similar experience in Santa Barbara. I think that perhaps the criticism of our diagnosis of hyperplasia is due to our using a wrong term. My conception of hyperplasia in these cases is that of a more or less chronic affection resulting in a hyperplasia of the mucous membrane and an osteoclasia in the bone beneath. This would show the changes found in the roentgenogram. The changes found in the Granger line and reported as hyperplasia mean just that—an osteoclasia and a thick-

ening of the membrane above. I was frankly surprised when both Dr. Beck and Dr. Mundt spoke of the dangers of the operation. Perhaps I am not familiar with the general rhinological practice, but not a single one of these cases we reported was operated upon. These mild cases are not being operated upon in Santa Barbara and I have never heard operation advocated. We used the word "treatment" in our paper, and that meant treatment by a competent rhinologist according to his idea of how the case should be treated. None considered operation necessary. Treatment consisted of shrinkage, mild suction, and the use of mild antiseptics at regular intervals. I can not give the details as I am not familiar with them, although I have had quite a little done for my own sinuses and know what the general plan is. Dr. Mundt spoke of the necessity of looking for developmental or other abnormalities. In preparing this paper we had no intention of covering the question of the roentgen diagnosis of sinus disease, but only to emphasize the necessity of searching the sphenoid region as well as the others. Any competent roentgenologist would know that he must take into consideration anything that can be demonstrated in the head by the roentgen ray in making his interpretation. The fact that a sinus appears duller than the average in one view does not necessarily mean sinusitis. One must take into consideration the depth of that particular sinus, *i.e.*, the amount of air in it. In interpreting frontal sinus films, if the sinus appears slightly duller than the average we turn to our lateral view to see if it is shallower than the average. Mistakes are made, of course, but one must pit his judgment against conditions.

Perhaps one of the difficulties Dr. Mundt spoke of is due to the fact that he prefers to interpret the films for himself. I do not mean that such procedure is necessarily wrong. I believe that each specialist should



learn to interpret his films, provided that he has the time and the inclination to do so. If a rhinologist has the time to study the physics of the roentgen ray as presented this afternoon, and the technic of taking the films so that he may recognize errors in tube position and allow for such errors when interpreting; if he will learn all the variations of normal and abnormal tissues in their permeability to the rays and then add to all this his knowledge of rhinology, he will be one of the best interpreters of head roentgenograms in the world. A busy rhinologist may not have time to do all this so he turns to roentgenologists whose specialty is the interpretation of variation from the average as shown on the roentgenogram. We do not make rhinological examinations, so when we develop a method of diagnosis such as Dr. Granger's we turn to the rhinologist to be checked up. We must accept his criticism; in fact, we welcome it. But the rhinologists must not criticize us too severely, until they have shown us that we are wrong. Where rhinologists have been willing to explore on the basis of findings by Dr. Granger, they have confirmed his interpretation.

I believe I answered Dr. Haessler's statement regarding different positions when I said that we used a number of positions when examining all the sinuses.

DR. HUME (closing): I quite agree with Dr. Beck and Dr. Mundt as regards conservatism in intranasal surgery. Perhaps the statements I have made concerning the indications for operation may seem radical, though I will add that Dr. Brown and Dr. Granger had some difficulty in convincing me that the surgery of the sphenoid would relieve these sufferers. All who were carefully studied before operation were suffering intensely and were economically useless unless relieved by some method. From our results in these cases I am convinced that through the aid of visual fields and Dr. Granger's radiologic contribution we will be able to diagnose and relieve many patients who have gone through the years the victims of incapacitating pain. Perhaps the intense cold of this northern climate might add to the post-operative discomfort, as considerably more space is given the nostril by this procedure; in our southern climate, however, the more open nose seems in no way to cause unpleasant symptoms.

# EDITORIAL

M. J. HUBENY, M.D. . . . . *Editor*  
BENJAMIN H. ORNDOFF, M.D. . . . . *Associate Editors*  
JOHN D. CAMP, M.D.

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Radiological Society of North America.*

## A CONSIDERATION OF SOME OF OUR PROBLEMS

I wish to present a few of the problems the solution of which will be of the greatest importance to the future of radiology.

All of you are familiar with the steps in the development of radiology as a science. Many of us have followed this development step by step. Since the discovery of the X-rays by Roentgen in 1895, marked progress has been made. At first a physical curiosity or discovery and of interest only in the field of physics, it has developed into one of the most valuable and precise methods of clinical diagnosis. Primarily it was a physical problem. Advances were made in the field of physics and by enterprising manufacturers, who were far-sighted and original enough to discern at least a part of the extended use to which this new and wonderful discovery might be put.

As the use of X-ray apparatus at that time required a great deal of mechanical and technical skill with which the physicians were unfamiliar, much of the early work was done by men outside the profession of medicine; that is, photographers, physicists, etc. As the value of this method of diagnosis began to be recognized, more study was put into the proper interpretation of films and into the technic of producing them. Inasmuch as this is an entirely medical field, physicians have become interested

and prepared themselves for the technical as well as the medical application.

During this experimental stage several of the experimenters received sufficient exposure to produce skin injuries. From this it was learned that the rays have a definite biological action upon living tissue. Thus was suggested the possibility of using this penetrating ray upon different forms of pathological lesions. Everything was at first claimed and every pathological lesion known treated, with the outcome that a few good results were obtained and many poor ones. These poor results, many coming on in later years, reacted to the disadvantage of X-rays and men who used them, so that for some time the method was in disrepute. However, as with many other methods in medicine, the constant use, combined with research, limited the application to its own field, until at the present time there are definite indications and contra-indications for the use of X-rays both in therapy and diagnosis.

While this evolution has practically eradicated the former mistakes, the injuries, the mistaken diagnoses, it has not eradicated one thing that in my mind is becoming a menace to the public and a menace to the future of radiology. The lay-technician may be technically perfect and from experience be able to diagnose many lesions correctly. Having no medical foundation for his work, he has not the background for entrance into the field of diagnosis. I have seen written reports of the X-ray findings, signed by a lay-technician as radiologist, that never could have been made by men trained in medicine because there was no evidence shown by the X-ray that would warrant such a diagnosis. Yet these reports

were accepted by the patient and by the physician who referred him as the final word in the diagnosis of the case; even accepted in court in some instances.

The lay-technician accepts cases for therapy without knowing the pathology which he is treating, the biological action of the rays, nor the results that he should get. Hence he makes extravagant statements, treats cases in which X-rays are definitely contra-indicated, with the resulting distrust of both the laity and the physicians in the true worth of this agent. Is this not trying to practise medicine? Why spend seven years in universities and hospitals learning to properly diagnose disease and treat the sick if all that is necessary is to buy an X-ray machine and spend two or three months, or even weeks in some cases, learning to operate it?

Such a practice as this calls for action from medical license boards and medical societies and it is the duty of a national organization such as this to recognize the danger and co-operate with state and local medical societies and license boards in the passage of laws or other methods to eradicate it.

We all know that a law can be enforced only when public opinion agrees with the law. Hence it rests upon us individually to create an opinion in the minds of the public by so conducting our work that we may obtain its respect and support.

We are now watching the evolution of a more recent type of therapy—physiotherapy—which includes practically all the mechanical and electrical means of treating disease. The greater number of these are in their infancy, in the stage where most of our information as to the benefits, indications, and contra-indications for application have come through a very few enthusiastic and perhaps over-enthusiastic physicians and certainly many over-enthusiastic manufacturers.

This form of therapy must of necessity pass through the same stages as radiotherapy. We could greatly shorten this period of evolution by the proper evaluation of results and records of all information now at hand. This would of necessity mean the appointment of a committee of well qualified men to examine these statistics and records, to place them in their proper classification and at their proper value. I would like to recommend the appointment of such a committee to co-operate with the existing committee of the American Medical Association so that together they might properly evaluate the various physiotherapeutic modalities. Such classification and evaluation will naturally lead to invaluable suggestions for further investigation of the useful methods and the elimination of the empirical use of useless methods. Inasmuch as these methods are chiefly a combination of electrical and radiant modalities, the radiologist is the logical and best-fitted one to take over the development of this newer form of therapy, because he has only recently had experience with the evolution of radiotherapy. Perhaps in many cases it will be merely an added burden, but unless we wish to see this valuable therapeutic agent falling into the hands of the laymen, the lay-technicians, quacks, and chiropractors, I feel it is our duty to accept this burden and take it from its empirical status and place it upon a practical basis.

Medical education with reference to radiology brings to our attention another condition, the rather haphazard way in which radiology is taught, both in under-graduate and post-graduate schools. In going over the bulletins of the different post-graduate schools, I find a great diversity in the curriculum offered, in some instances the subjects listed being taught, in part, at least, by a layman. Can not we have uniformity in the methods and time allotted to this

specialty, just as well as in other major subjects?

I would recommend that this Society appoint a committee to co-operate with the College of Radiology, the College of Surgeons, the College of Physicians, and the American Medical Association for the purpose of standardizing under-graduate and post-graduate education in radiology. This might well apply also to the training of technicians, much as has been done with the training of the nurses, the assistants to the surgeons and internists.

We have in the Radiological Society of North America the largest and, I think, the best organization of its kind in the world, an organization in which the members are chosen for their ability, experience, and standing in their community. Let us stand shoulder to shoulder in the solution of our problems, some of the most urgent of which

I have just mentioned. Surely they are not too great for us to solve. Let me also urge that the entire force and influence of this organization be directed toward the advance of radiology and toward better co-operation between the radiologist and his brothers in medicine and the specialties.

B. C. CUSHWAY, M.D.

#### THE SCIENTIFIC EXHIBIT

Dr. E. C. Samuel, 3503 Prytania Street, New Orleans, the local chairman of the scientific exhibit of the approaching meeting of the Radiological Society of North America to be held in New Orleans, November 28 to December 2, inclusive, will appreciate immediate communication from those members wishing to make displays at this meeting, in regard to space required, character of exhibit, etc.



Patio in the French Quarter, the Vieux Carré, of New Orleans. The basis of the picturesqueness of New Orleans is the architecture that was peculiar to the city in its early days.

## THE NEW ORLEANS MEETING

## TIPS FOR TRAVELLERS

On account of the prevalence of the regular winter tourist rates to New Orleans and return, it has been decided that it will be inadvisable to apply for the usual convention rates. Practically all who attend the meeting from any considerable distance will take in some of the side trips, go on the Panama-Cuba Cruise, or stay over in the South for a more or less extended period, and wisely so. The regular winter tourist rates permit of a prolonged stay, while the usual convention rates make it necessary to buy the tickets within a few days of the date of the meeting and return over the same route within a couple of days after the close of the meeting. The difference in these rates is so small as to be inconsiderable. The winter tourist rates are in effect from October 15 to May 31.

## A SPECIAL TRAIN

A special train or special Pullman coaches attached to a regular train—depending upon how many make reservations—will be run from Chicago to New Orleans *via* the Illinois Central Railroad.

Stops will be made at Champaign, Mattoon, Carbondale, Fulton, Memphis, and Jackson so that passengers may join the party at these points. If we have enough for a special train—and this is altogether likely—we will be able practically to make our own schedule. In any event, we will be able to make the trip with the usual pleasant company and good camaraderie of previous occasions.

The time of departure from Chicago has not been decided upon. So that the greatest number may receive due consideration, the Illinois Central R. R. will communicate directly with all members affected by this train, giving two tentative schedules, so that all who are interested may express a pref-

erence. *Be sure to fill out the return card and mail it as soon as it is received.*

Schedules for passengers from Cincinnati, Louisville, Kansas City, and other points will be arranged for all who apply. Naturally, passengers from eastern, western, and northern points will come *via* Chicago. See that your tickets read *via* Illinois Central Railroad from Chicago (or intersecting points) to New Orleans.

You all are invited to write me as soon as you decide to attend the meeting, and to plan your trip so as to meet the special train at the most convenient point. I will have diagrams of the coaches, and will assign berths in the order for which they are asked. The railroad company will acknowledge receipt of all reservations made through me.

## THE POST-MEETING CRUISE

As previously announced in this journal, a splendid cruise to Cuba, Honduras, and Panama, immediately following the close of the meeting at New Orleans, has been planned. At this writing, this promises to be a pronounced success. Already about one-half the capacity of the *S. S. Parismina* has been spoken for—about three months before the sailing date.

The Sociedad Cubano de Radiologia de Habana (Society of Cuban Radiologists of Havana) is planning quite an elaborate program for the entertainment of our party. This will, of course, be in addition to the regular side trips, etc., furnished by the United Fruit Co. Dr. Alfredo Dominguez (Secretary of the Havana organization) and his wife will probably accompany our party on the cruise from Havana and remain with us until we return to that city. Other events of similar nature will be arranged as occasion presents.

There is still some quite desirable space in this fine ship to be had, and those who care to may still secure accommodations and



the opportunity to make this splendid cruise in the company of friends.

Those unable to make the entire cruise may go to Havana and return. Space for this short trip is limited.

All applications for accommodations must be made through the undersigned. See page 80 of *RADIOLOGY* for July, 1927, and write immediately.

I. S. TROSTLER, M.D.,  
812 Marshall Field Annex,  
Chicago.

*Mgr. Commercial Exhibits and Transportation, The Radiological Society of North America.*

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#### DR. S. B. CHILDS HONORED

At the State Meeting of the Colorado Medical Society, at Glenwood Springs, September 8, Dr. S. B. Childs, of Denver, was elected President. Dr. Childs has been actively interested in the development of the Radiological Society of North America since 1919.

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#### SECOND INTERNATIONAL CONGRESS OF RADIOLOGY

STOCKHOLM, JULY 23 - 27, 1928

##### *Travel Information*

Each Congress member will arrange his journey to Stockholm himself through the travel bureaus in the respective countries.

The Travel Bureau of the Swedish State Railways, which will have a branch office at the Congress Bureau for the service of the Congress members, has an office in New York, as follows: Swedish State Railways Travel Information Bureau, 52 Vanderbilt Ave. Telegrams: Swedtravel.

The address of the Swedish American Line's office in New York is 21 State Street.

During the Congress the above mentioned branch office at the Congress Bureau will be at the service of Congress members with information as to travelling in Sweden and

trips in the vicinity of Stockholm. Details will be furnished later to members attending the Congress. The Travel Bureau of the Congress will also, if requested, furnish advice and information regarding arrangements for the return journey. Congress members should, however, make certain of their tickets in good time in fixing their routes, particularly cabin tickets on the boats for the return journey.

The Secretariat-General will arrange for rooms for Congress members who notify him of their intention to attend the Congress before May 31, 1928. Upon receipt of such notice the Secretary-General will immediately send a form on which each person can give details of his or her wishes regarding rooms.

All communications should be addressed to the *Secretary-General, International Congress of Radiology, Sophiahemmet, Stockholm, Sweden.*

Kindly notify of your desire to participate in the Congress as soon as possible so that the Secretary-General may be able to make all necessary arrangements for your convenience and comfort.

THE ORGANIZING COMMITTEE,

By AXEL RENANDER,  
*Secretary-General.*

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#### AN INTERESTING LEGAL PRECEDENT

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##### DUCTILE TUNGSTEN IN THE UNITED STATES

It will be observed with interest that, according to a recent decision of a United States Court, the Coolidge patent for the production of tungsten wire ductile in the cold state has been declared invalid, on the ground that the ductility is a natural property of the metal and is not patentable. This decision follows that of the House of

Lords two years ago, which was based on similar reasoning. Apparently the legal view was that tungsten wire, if it existed, was inherently ductile, and its production was merely the result of normal progress in the art of the metal-worker.

Apart from commercial considerations, our sympathies are with the inventor of the process which made the drawn-wire lamp practicable and effected a great forward step in the history of the incandescent lamp. The injury is aggravated by the fact that the Edison Medal for 1926 was awarded to Dr. Coolidge in December last for the origination of ductile tungsten and the improvement of the X-ray tube, and he has felt obliged to decline that great honor owing to this adverse decision. Whilst we do not question the propriety of his action in this matter, we feel that the fact is regrettable; the distinction was well earned, and it is unfortunate that the award should be nullified merely on the ground of a legal interpretation of the claims of his letters patent. Dr. Coolidge's electrical confrères are well aware of the real value of his work on the tungsten lamp, which is in no way affected by the Court's decision.—*The Electrical Review*, Feb. 25, 1927, C, 2570, p. 286. Reprinted from the *British Journal of Radiology*, July, 1927, XXIII, No. 92, p. 223.

#### SERIOUS RISKS IN THE TREATMENT OF TUBERCULOUS ADENITIS

##### REPORTED FROM ABROAD

Several cases were recently reported by Dr. Cassute and Dr. Hayat, before the medical society of Tunis, in which serious consequences followed the roentgen-ray treatment of tuberculous adenitis. In the case of

a child, tuberculous meningitis developed, terminating in convulsions and death, though the case, when given a few treatments, had seemed one of ordinary cervical adenitis. In the case of a woman, the large cervical adenopathies, for which she had been given three treatments, disappeared, but fever came on, and in the course of two months' time both apices were acutely infiltrated, and death ensued.

The physicians who reported these cases urged extreme conservatism in the treatment of cases of tuberculous adenitis with the roentgen rays.

#### PROTECTION FROM RADIANT ENERGY

The Physics Department of the National Physical Laboratory has issued a revised brochure containing the "Recommendations of the X-ray and Radium Protection Committee." This is the result of considerable effort and contains much valuable information.

A copy of this brochure may be had by writing Dr. Stanley Melville, c/o British Institute of Radiology, 32, Welbeck Street, W. 1, London, England.

#### COMMERCIAL EXHIBIT SPACE SOLD OUT

Before the end of September, Dr. I. S. Trostler, Manager of Commercial Exhibits, announced that all the space for the Thirteenth Annual Meeting of the Radiological Society of North America, to be held at the Hotel Roosevelt, New Orleans, November 28–December 2, inclusive, was sold out. This seems to indicate satisfaction with the returns from this annual exhibition of apparatus and roentgenologists' supplies.

# PRELIMINARY PROGRAM, RADIOLOGICAL SOCIETY OF NORTH AMERICA

NOVEMBER 28 - DECEMBER 2, 1927

HOTEL ROOSEVELT, NEW ORLEANS, LOUISIANA

<i>Forenoon</i>	<i>Afternoon</i>	<i>Evening</i>
Monday 8:30 A.M.-12 Noon Arrival. Registration. Opening of Scientific and Commercial Exhibits.	1:30-4:00 P.M. Scientific session: Papers on Pure Science in Biophysics, Research, Measurements, New Equipment, etc. 4:00-5:30 P.M. Clinics. Special conference with sci- entific exhibitors.	6:30 P.M. Counselors' Dinner, "Dutch." All members invited. Executive session follow- ing.
Tuesday 8:30 A.M.-12 Noon Scientific session.	1:30 P.M. Election of Officers. 2:00-4:00 P. M. Scientific session. 4:00-5:30 P.M. Clinics. Special conference with sci- entific exhibitors.	8:00 P.M. Scientific session. "New Orleans Night." City Local County Medical State Dental Radiological
Wednesday 8:30 A.M.-12 Noon Scientific session.	1:30-4:00 P.M. Scientific session. 4:00-5:30 P.M. Clinics. Special conference with sci- entific exhibitors.	8:00 P.M. Scientific session. "Guest Night."
Thursday 8:30 A.M.-12 Noon Scientific session. (two sections)	1:30-4:00 P.M. Scientific session (2 sects.). 4:00-5:30 P.M. Clinics. Special conference with sci- entific exhibitors.	7:00 P.M. Convocation. Banquet. Dancing.
Friday 8:30 A.M.-12 Noon Scientific session.	1:30-2:00 P.M. Installation of Officers. 2:00-4:00 P.M. Scientific session. 4:00-5:30 P.M. Clinics. Special conference with sci- entific exhibitors.	
Saturday Sight-seeing—Visit to Leper Colony—Cruises—Starting home.		

FOREIGN GUESTS WHO ARE EXPECTED TO BE  
PRESENT

- DR. H. BEHNKEN, Berlin, Germany  
Standardization of Roentgen Dosage.
- DR. J. FORESTIER, JR., Aix - les - Bains,  
France  
The Use of Lipiodol in Neurology.  
Films of Aix-les-Bains.
- PROF. DR. FRANZ M. GROEDEL, Bad-Nau-  
heim, Germany  
The Differential Diagnosis of the Syph-  
ilitic Diseases of the Visceral Organs.  
Short Demonstration: Diverticulitis Coli.  
The Physical Treatment of the Diseases  
of the Circulatory Apparatus.
- DR. HERMAN HOLTHUSEN, Hamburg, Ger-  
many  
Biological Aspects of Therapy Radiation.  
The Present Status of Dosage Measure-  
ments.
- DR. A. LACASSAGNE, Paris, France  
Pathological Aspects of Radiation  
Therapy.

In correspondence with others who, we  
have reason to expect, will be present.

ALPHABETICAL LIST OF ESSAYISTS AND  
THEIR SUBJECTS

- DR. ROBERT A. ARENS and DR. IRVING F.  
STEIN, Chicago, Illinois  
Roentgen Diagnosis in Gynecology—  
Iodized Oil and Pneumoperitoneum  
Combined.
- DR. JOSEPH ASPRAY, Spokane, Washington  
Results of the Oral Method of Chol-  
ecystography.
- DR. C. C. BASS, New Orleans, Louisiana  
Relation of Radiology to Medical Edu-  
cation.
- DR. H. BEHNKEN, Berlin, Germany  
Standardization of Roentgen Dosage.
- DR. W. W. BELDEN, New York City  
Paget's Disease, Osteitis Fibrosa and  
Closely Allied Bone Diseases.
- DR. W. R. BETHEA, Memphis, Tennessee  
Intra-cranial Study by Ventriculogram.
- DR. GEORGE E. BINKLEY, New York City  
The Use of Radium in the Treatment of  
Rectal Cancer.
- DR. EDWARD S. BLAINE, Chicago, Illinois  
An Unusual Foreign Body in the Kidney.
- DR. W. B. BOWMAN and DR. L. S. GROIN,  
Los Angeles, California  
Roentgen Findings in Some Obscure  
Kidney Lesions.
- DR. W. F. BRAASCH, Rochester, Minnesota  
Radiography of the Urinary Tract.
- DR. WALTER BRONSON, Chicago, Illinois  
Functional Distortions of the Gastric  
Contour.  
Undergraduate Instruction in Roentgen-  
ology.
- DR. SAMUEL BROWN, Cincinnati, Ohio  
Mechanical Explanation of the Biological  
Action of Radiation.
- DR. CURTIS F. BURNAM, Baltimore, Mary-  
land  
External Distance Applications of Heavi-  
ly Filtered Radium.
- DR. WILLIS CAMPBELL, Memphis, Ten-  
nessee  
The Importance of X-ray Diagnosis and  
Supervision in the Treatment of Frac-  
tures Involving Joints.
- DR. JAMES T. CASE, Battle Creek, Michigan  
Evaluation of Cholecystography in the  
Light of Operative Findings (three  
hundred cases operated upon).
- DR. W. EDWARD CHAMBERLAIN, San Fran-  
cisco, California  
Practical Dosimetry.
- DR. GEORGE L. CLARK, Urbana, Illinois  
Marvelous Advance in the Application of  
X-rays.
- PROF. W. W. COBLENTZ, Washington, D. C.  
Subject not yet arranged. (Paper to be  
read by title.)
- DR. LEWIS GREGORY COLE, New York City.  
Do Gastric Ulcers Frequently Become  
Malignant? Roentgenological Aspect.
- DR. A. W. CRANE, Kalamazoo, Michigan  
Subject not yet arranged.

- DR. B. C. CUSHWAY, DR. R. J. MAIER, DR. W. H. BOHART, Chicago, Illinois, and DR. E. J. CAREY, Milwaukee, Wisconsin  
Anatomical Variations in the Symptomless Spine.
- DR. WHEELER P. DAVEY, State College, Pennsylvania  
Application of X-ray in Crystal Analysis and in the Arts.
- DR. A. U. DESJARDINS, Rochester, Minnesota  
Leader of Symposium on Physical Therapy.
- DR. CLYDE O. DONALDSON, Kansas City, Missouri  
Treatment of Cancer of the Cervix.
- DR. JAMES J. DUFFY, New York City  
The Use of Gold Tubes of Radium Emanation.
- DR. CHARLES W. DUVAL, New Orleans, Louisiana  
Do Gastric Ulcers Frequently Become Malignant? Pathological Aspect.  
The Consideration of the Pathology of Certain Splenomegalies.  
Paper in cancer symposium, subject not yet arranged.
- DR. EDWIN C. ERNST and DR. W. T. BURREWS, St. Louis, Missouri  
Paper in cancer symposium, subject not yet arranged.
- DR. ARTHUR W. ERSKINE, Cedar Rapids, Iowa  
Leader of symposium on Practical Dosimetry.
- DR. W. L. ESTES, Bethlehem, Pennsylvania  
Fractures of the Femur.
- DR. JAMES A. EVANS, La Crosse, Wisconsin  
Duodenal Stasis.
- DR. J. FORESTIER, JR., Aix - les - Bains, France  
The Use of Lipiodol in Neurology.  
Films of Aix-les-Bains.
- DR. ROBERT H. FRASER, Battle Creek, Michigan  
Diagnostic Use of Lipiodol in the Paranasal Sinuses.
- DR. MAURICE J. GELPI, New Orleans, Louisiana  
Review of Various Methods of Treatment of Carcinoma of the Cervix; Primary Mortality and Five- or Seven-year Cures.
- DR. M. J. GEYMAN, Santa Barbara, California  
Osteochondritis Dissecans.
- DR. OTTO GLASSER, Cleveland, Ohio  
Physical Factors that Govern Radiation Dose.
- DR. F. B. GRANGER, Boston, Massachusetts  
Subject not yet arranged.
- DR. GEORGE W. GRIER, Pittsburgh, Pennsylvania  
Surface Applications of Radium.
- PROF. GRIFFITH, Aberdeen, Scotland  
Subject not yet arranged. (Paper to be read by title.)
- PROF. DR. FRANZ M. GROEDEL, Bad-Nauheim, Germany  
The Differential Diagnosis of the Syphilitic Diseases of the Visceral Organs.  
Short Demonstration: Diverticulitis Coli.  
The Physical Treatment of the Diseases of the Circulatory Apparatus.
- DR. HENRY W. GROTE, Bloomington, Illinois  
Status Lymphaticus.
- DR. W. H. GUY, Pittsburgh, Pennsylvania  
X-ray Therapy in Non-malignant Dermatological Conditions.
- DR. WILLIAM H. HARRIS, New Orleans, Louisiana  
Etiology of Cancer, from Biological Experimental Work on Dogs and Rabbits.
- DR. MELVIN S. HENDERSON, Rochester, Minnesota  
The Importance of an Accurate Technic for Apposition and Immobilization in



- the Bone Graft Treatment of Fractures.  
(With X-ray lantern slides.)
- DR. RALPH E. HERENDEEN, New York City  
The X-ray Treatment of Bone Tumors.
- DR. JOHN T. HERRICK, Ottumwa, Iowa  
Treatment Records.
- DR. PRESTON M. HICKEY, Ann Arbor, Michigan  
The Anatomy of the Larynx from the Radiological Standpoint.
- DR. I. SETH HIRSCH, New York City  
The Malacias (Von Recklinghausen).  
Heliotherapy for Roentgenologists. A travelogue which will describe the therapeutic effects of a vacation in Italy, Greece, and Turkey.
- DR. HERMAN HOLTHUSEN, Hamburg, Germany  
Biological Aspects of Therapy Radiation.  
The Present Status of Dosage Measurements.
- DR. RALPH HOPKINS, New Orleans, Louisiana  
Leprous Bone Lesions.
- DR. E. L. JENKINSON, Chicago, Illinois  
Subject not yet arranged.
- DR. FRED JOHNSON, Atlanta, Georgia  
The Present Status of Buried Unfiltered Radium Emanation.
- DR. ZOE ALLISON JOHNSTON, Pittsburgh, Pennsylvania  
The Use of Radium in the Treatment of Nevi.
- DR. MAX KAHN, Baltimore, Maryland  
X-ray Treatment of Bone Tumors, with Special Reference to Tumors of Unconfirmed Diagnosis.
- DR. MAURICE L. KAPLAN, Chicago, Illinois  
X-ray Therapy in Blood Dyscrasias.
- DR. B. R. KIRKLIN, Rochester, Minnesota  
Normal Cholecystographic Response.
- DR. L. C. KNOX, New York City  
Radiation Sensitiveness and Tumor Morphology.
- DR. A. LACASSAGNE, Curie Institute, Paris, France  
Pathological Aspects of Radiation Therapy Results.
- DR. HARRY LAURENS, New Orleans, Louisiana  
Subject not yet arranged.
- DR. WALTER I. LE FEVRE, Cleveland, Ohio  
Polyradiotherapy in Dermatology. (Lantern slides.)
- DR. LESTER LEVYN, Buffalo, New York  
The Role of Pregnancy in the Production of Gall-bladder Pathology as Revealed by Cholecystography.
- DR. HORACE LO GRASSO, Perrysburg, New York  
Subject not yet arranged.
- DR. WILLIAM CARPENTER MACCARTY, Rochester, Minnesota  
The Cancer Cell in the Practice of Medicine.
- DR. J. M. MARTIN, Dallas, Texas  
Motion picture films—The Cancer Problem; X-ray Treatment in Acne; Radium in the Treatment of Birthmarks.
- DR. D. B. MARTINEZ, Pittsburgh, Pennsylvania  
Iodized Oil in the Diagnosis of Pregnancy.
- DR. RUDOLPH MATAS, New Orleans, Louisiana  
Life of Lord Lister.
- DR. EDGAR MAYER, Saranac Lake, New York  
Clinical Application of Sunlight and Artificial Radiation.
- DR. CHARLES MCCOY, Cleveland, Ohio  
Development of Roentgenological Examination of the Biliary Tract.
- DR. F. M. MCPHEDRAN and DR. C. N. WEYL, Philadelphia, Pennsylvania  
The Value of Synchronization in Accurate Diagnosis of Chest Diseases.
- DR. JOHN T. MURPHY, Toledo, Ohio  
Calcifications of the Skull, Brain, etc.

- DR. J. H. MUSSER, New Orleans, Louisiana  
Radiology in Relation to Internal Medicine.
- DR. N. J. NESSA, Sioux Falls, South Dakota  
Roentgen Diagnosis of Anencephalus Preliminary to Delivery.
- DR. N. B. NEWCOMER, DR. ELIZABETH NEWCOMER, and DR. C. A. CONYERS, Denver, Colorado  
Conclusions Based upon the Routine Intravenous Administration of Sodium Tetraiodophenolphthalein in Gall-bladder Diagnosis.
- DR. CARL S. OAKMAN, Muncie, Indiana  
Correlation of Cholecystography and the Barium Meal.  
A Practical Cross Index System for Roentgenologists.
- DR. ALTON OCHSNER, New Orleans, Louisiana  
Bronchography According to the Passive Technic: the Method of Choice for the Roentgenologist.
- DR. BENJAMIN H. ORNDOFF, Chicago, Illinois.  
A Study of Reverse Movements in the Contents of the Duodenum.
- DR. H. WINNETT ORR, Lincoln, Nebraska  
An Analysis of End-results in Compensation Fracture Cases, with X-ray Demonstration of the Causes of Disability.
- DR. RALPH PEMBERTON, Philadelphia, Pennsylvania.  
The Nature and Treatment of Arthritis, with Consideration of the Rationale Underlying Some Forms of Physiotherapy Useful in this Disease.
- DR. GENTZ PERRY, Rhinelander, Wisconsin  
The Radiologist and His Ethics.
- DR. HENRY C. PILLSBURY, Fort Sam Houston, Texas  
The Progress of Roentgenology in the Army.
- DR. E. A. POHLE and DR. J. M. BARNES, Ann Arbor, Michigan  
Practical Dosimetry.
- DR. U. V. PORTMANN, Cleveland, Ohio  
Radiation Therapy in Carcinoma of the Breast: Supplementary Report.
- DR. R. P. POTTER and DR. W. G. SEXTON, Marshfield, Wisconsin.  
Anomalies of the Ureters and the Kidney Pelves.
- DR. BYRON S. PRICE, New York City  
Subject not yet arranged.
- DR. DOUGLAS QUICK, New York City  
Technical Methods of Radium Application (Leader of Symposium).
- DR. D. T. QUIGLEY, Omaha, Nebraska  
Some Neglected Points in the Pathology of Breast Cancer; and Treatment of Breast Cancer.
- EDITH H. QUIMBY, M.A., New York City  
The Intensity of Radiation in the Vicinity of Filtered Radon Implants.
- DR. H. E. ROBERTSON, Rochester, Minnesota  
Pathologic Anatomy and Radiology: Their Relations and Significance.
- DR. MARION M. ROLAND, Oklahoma City, Oklahoma  
A Clinical Review of the Treatment of Breast Cancer.
- DR. I. C. RUBIN, New York City  
Lipiodol in Gynecology.
- DR. LEROY SANTE, St. Louis, Missouri  
Pneumothorax.
- DR. HENRY SCHMITZ, Chicago, Illinois  
Cancer of the Cervix.
- DR. DANIEL N. SILVERMAN, New Orleans, Louisiana  
Results of Recent Experimental Research on Gall-bladder Function.
- DR. SIDNEY K. SIMON, New Orleans, Louisiana  
Do Gastric Ulcers Frequently Become Malignant? Viewpoint of Gastroenterology.
- DR. C. AUGUSTUS SIMPSON, Washington, D. C.  
Cartilage Malignancy Associated with Epitheliomas.

DR. E. H. SKINNER and DR. I. H. LOCKWOOD, Kansas City, Missouri

Gall-bladder Pathology as Revealed by Cholecystography in the Presence of Infectious Arthritis, Pernicious Anemia and Myocardial Degeneration.

DR. LESTER A. SMITH and DR. H. O. MERTZ, Indianapolis, Indiana

Spina Bifida Occulta and Urological Problems of Childhood.

DR. ALBERT SOILAND, Los Angeles, California

Deep Sea Ramblings of a Radiologist.

DR. ALBERT SOILAND, DR. WILLIAM E. COSTLOW, and DR. ORVILLE N. MELAND, Los Angeles.

The Rôle of Radiation Therapy in Pelvic Conditions Associated with Infections.

DR. M. C. SOSMAN, Boston

Leader of Spine Symposium.

DR. J. THOMPSON STEVENS, Montclair, New Jersey.

Present-day Methods in the Treatment of Carcinomata of the Breast.

DR. ROLLIN H. STEVENS, Detroit, Michigan  
Leader of symposium on Cancer.

DR. PAUL F. TITTERINGTON, St. Louis, Missouri.

Fractures of the Bones of the Face.

DR. H. J. ULLMANN and DR. M. J. GEYMAN, Santa Barbara

Osteochondritis Dissecans.

DR. W. WARNER WATKINS and DR. HARLAN P. MILLS, Phoenix, Arizona

Routine Cholecystography, Based upon Five Hundred Examinations.

DR. E. G. C. WILLIAMS, Danville, Illinois  
Elective Menopause.

DR. SANFORD WITHERS and DR. JOHN R. RANSON, Denver, Colorado.

The Use of Radium Element Needles.

DR. FRANCIS CARTER WOOD, New York City

Biology of Cancer.

SYMPOSIA HAVE BEEN ARRANGED ON THE FOLLOWING SUBJECTS:

#### CANCER

Leader, DR. ROLLIN H. STEVENS, Detroit, Michigan.

#### CHOLECYSTOGRAPHY

Leader, DR. JAMES T. CASE, Battle Creek, Michigan.

#### FRACTURES

Leader, DR. H. WINNETT ORR, Lincoln, Nebraska.

GASTRIC ULCER—Do Gastric Ulcers Frequently Become Malignant?

Leader, DR. LEWIS GREGORY COLE, New York City.

#### LIPIODOL

Leader, DR. M. J. HUBENY, Chicago, Illinois.

#### PHYSICAL THERAPY

Leader, DR. A. U. DESJARDINS, Rochester, Minnesota.

#### PRACTICAL DOSIMETRY

Leader, DR. ARTHUR W. ERSKINE, Cedar Rapids, Iowa.

RADIUM—Technical Methods of Radium Application.

Leader, DR. DOUGLAS QUICK, New York City.

#### SPINE

Leader, DR. M. C. SOSMAN, Boston.

#### CLINICS

##### Monday

DR. EDWARD S. BLAINE.

Practical Phases, Technic and Interpretation of Bone and Joint Injuries.

##### Tuesday

DR. CHARLES G. SUTHERLAND.

Bone Infections.

##### Wednesday

DR. J. C. BLOODGOOD.

Bone Tumors.

*Thursday*

DR. AMEDEE GRANGER.  
Sinuses and Mastoids.

*Friday*

DR. C. A. WATERS.  
Arthritis.

*Monday*

DR. LEWIS GREGORY COLE.  
Methods of Serial Roentgenography  
in the Diagnosis of Gastro-intestinal  
Lesions.

*Tuesday*

DR. BENJAMIN ORNDOFF.  
The Stomach and Duodenum.

*Wednesday*

DR. JAMES T. CASE.  
The Colon.

*Thursday*

DR. SHERWOOD MOORE.  
Cholecystography.

*Friday*

DR. B. H. NICHOLS.  
Urinary Tract.

*Monday*

DR. ARTHUR W. ERSKINE and DR. E. A.  
POHLE.  
Problems in Practical Dosimetry.  
DR. W. E. CHAMBERLAIN and DR. OTTO  
GLASSER.  
Problems in Practical Dosimetry (con-  
tinued).

*Tuesday*

DR. SANFORD WITHERS.  
Treatment of Malignancy of the Head  
and Neck.

*Wednesday*

DR. A. U. DESJARDINS.  
Lymphoblastoma.

*Thursday*

DR. BURTON J. LEE.  
Treatment of Carcinoma of the Breast.

*Friday*

DR. HENRY SCHMITZ.  
Treatment of Diseases of the Female  
Pelvic Organs.

*To be arranged:*

DR. P. M. HICKEY.  
Localization of Foreign Bodies in the  
Eye.

DR. L. R. SANTE.  
Acute Non-tuberculous Conditions in  
the Chest.

DR. J. FORESTIER.  
Lipiodol in Chest Diagnosis.

Other clinics in the process of arrange-  
ment.

## ANNOUNCEMENTS

Register on arrival.

Admission to clinics by tickets obtained  
at the Registration Desk.

Arrange at Registration Desk for Satur-  
day's visit to Leper Colony.

Members invited with interesting films  
and case histories for the proper clinics.

Scientific and commercial exhibits are  
open for visitation during the daytime.

Exhibitors in the Scientific Exhibit are  
requested to be present each day from 4 to  
5:30 P.M.

Our program is one day shorter and one  
and one-half hours shorter each day than  
usual.

Members are allowed twenty minutes for  
their entire presentation; guests, thirty  
minutes; for guests from abroad special ar-  
rangements will be made.

The final program will appear in the next  
issue (December).

The program is now full.

# ABSTRACTS OF CURRENT LITERATURE

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**Spleen exposure in skin diseases.**—A number of skin diseases, as, for instance, furunculosis, lupus, tuberculosis of the mucous membrane, seem, in the author's opinion, to be benefited by irradiation of the spleen. Very small doses were used, 1.5 to 2.0 X through 3.0 Al. (25 cm. spark gap, 1.5 ma., 25 cm. F.S.D., one to two minutes).

E. A. POHLE, M.D.

*Regarding Spleen Exposure in Skin Diseases. Franz Thedering. Strahlentherapie, 1927, XXV, 328.*

**Peptic ulcer.**—Transplants of jejunum with intact blood supply, from the region where gastrojejunal ulcer develops following gastro-enterostomy in man, were made into the lesser curvature of the stomach, in dogs, at the site where gastric ulcer usually occurs in man. A typical peptic ulcer developed in the transplant in a small percentage of instances. This fact appears significant, as no ulcers developed when the transplant was made elsewhere in the gastric wall.

The results of these experiments add more suggestive data to the hypothesis that mechanical stress is an important factor in determining the site of formation of peptic ulcer.

C. G. SUTHERLAND, M.B. (TOR.)

*The Effect on the Jejunal Mucosa of Transplantation to the Lesser Curvature of the Stomach. Geza de Takats and Frank C. Mann. Ann. Surg., May, 1927, LXXXV, 698.*

**The effect of roentgen rays on blood vessels.**—In this second phase of his experiments, the author exposed the ears of rabbits to roentgen rays (60 K.V., 2 ma. 1.0 Al., 23 cm. F.S.D., 23 minutes = 150 per cent E.D.), and in various intervals (5 minutes to 3 months) following the irradiation, the ears were half submerged in hot water at 53 degrees Centigrade or 0.3 c.c. of croton oil applied to the upper half. Both procedures caused on the normal ears hyperemia and inflammation; it appeared that the treated ears showed a higher degree of inflammation if this was provoked within two weeks after the exposure. Within an interval of two to five weeks, no difference could be noted at all; an interval of five to eight weeks, however, brought out a more severe reaction in the previously irradiated ears as compared with the controls and also with the reaction observed within two weeks after the irradiation. The roentgen-ray reaction in the ears of rabbits



evidently appears, therefore, in two cycles, one representing the early reaction and the second one the true reaction. The first period is a constant while the second may not be present, particularly if a small dose of roentgen rays has been used.

E. A. POHLE, M.D.

*Regarding Changes of the Functional Stage of Blood Vessels Following Roentgen Irradiation. Second Communication: On the Influence of Roentgen Irradiation upon the Following Development of Inflammatory Processes. N. W. Lazarew. Strahlentherapie, 1927, XXV, 255.*

**Cardiolysis.**—Cardiolysis is a surgical therapeutic measure for the relief of adherent pericarditis complicated by intrapericardiothoracic adhesions. The pulling in of the chest wall with each systole of the heart, with which its pericardium is bound by adhesions to the intrathoracic parietes, produces a damaging degree of extra labor on the heart. This condition is readily diagnosed by X-ray methods. The operation for the relief of the condition contemplates the excision of the osteocartilaginous portion of the chest wall over the adherent area, thereby removing an unyielding chest wall.

Roentgenograms are submitted showing the change in cardiac outline after the performance of the operation.

L. R. SANTE, M.D.

*Cardiolysis for Mediastinopericarditis, with Case Report. James A. Mattison. Surg., Gynec. and Obst., January, 1927, p. 113.*

**Early malignancy of the larynx.**—British surgery reports good results from laryngofissure, while American surgeons regard laryngectomy as the treatment of choice. In contrast with these views the author reports good results from the use of electro-desiccation and radium. Two cases are reported, one patient being alive and well five years after, and the other two years.

The treatment is carried out in three stages. First, deep X-ray therapy is employed. Then the diseased area is thoroughly removed by electro-desiccation, through either the laryngeal speculum or the opened larynx. After the reaction has subsided, radium is used, intralaryngeally, or externally, or both.

In advanced cases laryngectomy is the treatment of choice.

L. J. CARTER, M.D.

*The Treatment of Early Malignancy of the Larynx Treated by Electro-desiccation and Radium. Robert H. Craig. Can. Med. Assn. Jour., March, 1927, p. 331.*

**Vertebral fractures.**—Considerable difference of opinion exists as to frequency, importance, and method of treatment of fractures of the transverse processes of the lumbar vertebrae. X-ray is an invaluable aid in diagnosis of the condition—at times diagnosis is impossible without its aid. It is almost generally agreed that the cause is from direct violence or muscular strain. The actual separation of the bony fragments does not represent the main injury: tearing of muscles and nerves is the most disabling part. The hospital stay for such uncomplicated fractures ranges from two to thirty-two days. Cotton states that the fracture "may not improbably unite by fibrous union without persistent symptoms." Osgood states that "fractures of the transverse processes recover if immobilized, but often remain ununited and painful if not recognized and treated." The essayist gives brief consideration to ten such cases. His conclusions are:

"1. Among injuries to the back, fractures of the transverse processes of the lumbar vertebrae are not rare, although it is to be emphasized that bony anomalies in this region are frequent, and may tend to confuse the diagnosis.

"2. The most common cause of fracture of the transverse processes is direct violence. The symptoms and physical signs are those of severe sprain or contusion of the back.

"3. Such fractures are usually multiple. When uncomplicated by body fracture, all the fractures are usually on the same side.

"4. The disability caused by the injury is due solely to the associated contusion or sprain of the back, and the presence of the fracture is negligible as far as prolongation of disability is concerned. Owing to the frequency of traumatic neurosis, it is preferable that knowledge of an existing fracture be kept from the patient.

"5. Bony union of the fractured transverse processes is definite in some of these cases.

"6. More careful examination of backs should be made before employing men over forty at hard labor.

"7. The treatment required is rest in bed, heat, and massage. Prolonged immobilization is no more necessary than in any contusion or sprain of the back.

"8. In this series patients were able to walk after an average period of sixteen days. Disability over six months is out of the ordinary. The majority should be at work within two months with practically no complaints referable to the injury."

L. R. SANTE, M.D.

*Fractures of the Transverse Processes of the Lumbar Vertebrae.* Robert H. Kennedy. *Ann. Surg.*, April, 1927, LXXXV, 519.

**Blood tests in radium cases.**—The author examined the blood of 40 cases of carcinoma of the cervix, 36 of which were inoperable. He found that in 50 per cent a drop of the red blood corpuscles and the hemoglobin followed the treatment; its degree seems to be independent of the amount of radiation. During the treatment period, the leukocytes decreased in number as low as 40 per cent of the original count. After return to normal, there was very often a relative lymphopenia. The blood platelets appeared rather augmented, although in some patients a drop was noted. No typical changes of the blood-clotting time could be observed. The sedi-

mentation speed of the erythrocytes was usually higher than before treatment. There was evidence that hopeless patients had a permanently high sedimentation rate. The possibility of using the sedimentation test for the prognosis in malignant diseases should be studied further.

E. A. POHLE, M.D.

*Blood Investigations during Radium Treatment in Patients with Carcinoma of the Cervix.\** Einar Rud. *Strahlentherapie*, 1927, XXV, 195.

**Tuberculous dactylitis.**—From 1920 to 1924, inclusive, 1,403 tuberculous patients attended the surgical out-patient department of the Royal Edinburgh Hospital for Sick Children. Ninety of these had tuberculous dactylitis. Most of the affections were assumed to be bovine. The small bones of the hands, feet, and the spine were most affected. Except in severe cases, recovery is often so complete that it is difficult to find the lesion's site.

C. G. SUTHERLAND, M.B. (TOR.)

*Tuberculous Dactylitis in Infancy.* G. Herzfeld and M. C. Tod. *Archiv. Dis. Childhood*, October, 1926, I, 295.

**Telangiectasis of the kidney.**—Report of a case of telangiectasis of the kidney—an extremely rare occurrence—presenting no clinical evidence except hematuria. This hematuria was probably due to communications between the telangiectatic spaces and the calyx, brought about by minute ulcerations through the pelvic membrane. Mottling was observed in the pyelogram and was considered characteristic of this vascular disturbance; it was probably due to the entrance of the pyelographic media into the vascular spaces through the minute ulcerations in the pelvic membrane.

The authors consider telangiectasis of the kidney unharmed to the patient except when hematuria occurs as a result of trauma or an

inflammatory process. Nephrectomy is indicated only when hematuria recurs, or when it is liable to cause an alarming anemia.

ROBERT A. ARENS, M.D.

*Telangiectasis of the Kidney Simulating Renal Tumor.* P. A. Jacobs and William Rosenberg. *Jour. Urol.*, March, 1927, p. 337.

**Biological effect of radiation.**—The author analyzes, in this article, the experiments of Nakashima, who finds his results in agreement with the heat point theory of Dessauer. From the standpoint of modern physics, and based on his own research, Holthusen comes to the conclusion that the point heat theory can not be accepted because its interpretation is partly in contrast with practical experience. Those interested in biophysics of radiation are referred to the original article.

E. A. POHLE, M.D.

*Fundamental Mechanism of the Biological Effect of Radiation.* H. Holthusen. *Strahlentherapie*, 1927, XXV, 157.

**Ultra-violet radiation in rickets.**—This is a good review of the rôle of light in the pathogenesis of rickets, and the treatment and prophylaxis of the disease. The possibility of an obligatory irradiation of young children with ultra-violet rays in order to prevent rickets is discussed. There is a rather complete international bibliography of three pages.

E. A. POHLE, M.D.

*Rickets and Ultra-violet Light.* Lutz Schall. *Strahlentherapie*, 1927, XXV, 121.

**Detection of primary carcinoma of jejunum.**—The author discusses in this clinical paper the occurrence, the symptomatology, diagnosis and treatment of this rather uncommon condition. He mentions that the cardinal symptoms of the ordinary low bowel obstruction are usually absent in a high obstruction. The diagnosis of high obstruction may be made readily by roentgenographic and fluoroscopic examinations, using the barium meal.

In one case a small lake of barium was seen for a few minutes in the upper portion of the small intestine shortly after it had passed through the duodenum; operation disclosed a carcinoma twelve inches below the duodeno-jejunal junction.

In the treatment of this condition early surgical removal of the growth and its mesentery, including a wide margin of surrounding tissue, with proper anastomosis, gives the best results.

In conclusion, he states that high intestinal obstruction due to primary carcinoma of the jejunum may be diagnosed if early and thorough serial barium roentgenographic and fluoroscopic examinations are made.

HOWARD P. DOUB, M.D.

*High Intestinal Obstruction Caused by Primary Carcinoma of the Proximal Jejunum.* William R. Morrison. *Am. Jour. Surg.*, February, 1927, p. 154.

**Prognosis in irradiated uterine carcinoma.**

—The author discusses the prognosis of the irradiated uterine carcinoma, based on the observations related in the literature and on his own, from a pathologico-anatomical standpoint. He states that carcinoma of the cervix appears in a striking number of varieties. The response of these to radiation differs greatly; even in two processes of the same extension, the dose required to cause regression varies considerably.

Regarding the help expected from animal experiments, it must be remembered that healthy animals are inoculated with tumor material. We can learn then how a normal organism reacts to a sudden invasion of malignant cells, but it is extremely difficult to draw conclusions from the effect of radiation on such animals.

In his histological studies, Lahm classifies the zone of reaction between normal and carcinomatous tissue into four groups, depending upon the prevalence of plasma cells, eosinophils, mixture of both, or fibroblasts and fibers.

Regarding the spontaneous cure of carcinoma, it is interesting to note that in many

cases the invasion of leukocytes follows as a secondary process the necrosis of the tumor cells. No evidence for the assumption that the connective tissue is promoting the necrosis of the malignant growth was found. It is essential, however, for the scar formation. Cornification takes place without assistance of the connective tissue; the frequent observation of very typical cells, called "pencil cells," suggests their importance in this process. As the principal histological difference between spontaneous change and that following irradiation, the author regards the fact that in the first case the protoplasm is degenerating while the nucleus remains intact; in the latter case the nucleus shows the first signs of injury. In conclusion, it is stated that irradiation does not induce a tissue reaction parallel to the one seen in "spontaneous cure." The future development should bring a method imitating Nature's ways in healing malignant tumors. (Strauss — See *Strahlentherapie*, 1927, XXIV, 672—comes to the opposite conclusion.—*Abstractor*.)

E. A. POHLE, M.D.

*The Prognosis of Uterine Carcinoma in the Light of the Microscopical Examination.* W. Lahm. *Strahlentherapie*, 1927, XXV, 22.

**Unusual case simulating ruptured ectopic pregnancy.**—The author describes an unusual case of necrosis of the ureter, perforation, and peri-ureteral abscess, with a sudden onset of symptoms simulating a ruptured

ectopic pregnancy. It is interesting because of the entire absence of any symptoms referable to the urinary tract. Gross pathology showed the unusual combination of lithiasis and tuberculosis, with autonephrectomy. Transfusion and a two-stage operation were resorted to.

ROBERT A. ARENS, M.D.

*Necrosis of the Ureter, Perforation, Peri-ureteral Abscess.* Nathaniel P. Rathbun. *Jour. Urol.*, March, 1927, p. 329.

**Gastro-intestinal examination for perforation.**—The author stresses the importance of the use of the roentgen rays in the diagnosis of suspected perforation of the gastro-intestinal tract. The presence of air or gas in the peritoneal cavity is important, where accurate diagnosis is vital and often very difficult. Perforations of the appendix show no gas in the peritoneal cavity as a rule. Of ten cases suspected, in four it was present and confirmed at operation. Five were negative in their X-ray findings; one of these was a ruptured spleen. The other four patients recovered without operation. The findings have been definite: a narrow sickle-shaped dark zone separating the liver from the diaphragm when the examination is made with the patient sitting up and holding the breath.

C. G. SUTHERLAND, M.B. (TOR.)

*Roentgenography in the Diagnosis of Gastro-intestinal Perforation.* M. H. Todd. *Am. Jour. Surg.*, May, 1927, n. s. II, 449.

